THE AMERICAN GAS LIGHT JOURNAL

REDMANAKENNY.N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME L.—No. 11. Whole No. 719. | NEW YORK, MONDAY, MARCH 18, 1889. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

Published on each Monday of the year, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.00 (17 shillings—20 francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY,
COLUMBUS, O., February 21, 1889.

To Members of the Ohio Gas Light Association:—As heretofore announced the Fifth Annual Meeting of this Association will be held at Mansfield, Ohio, March 20 and 21, 1889; the first day's session to begin at 9:30 A.M. standard time.

The following papers are promised for the meeting:

1. "The Methods of Taxation of the Different Gas Companies, and a Comparison of the Same," by H. Wilkiemeyer, Portsmouth, Ohio.
2. "Fuel Gas and Incandescent Gas Lighting," by Edward Lindsley, Cleveland, Ohio.
3. "Gas Monopoly," by W. W. Cantine, Alliance, Ohio.
4. "A Holder-Tank Problem," by Geo. H. Tayler, Warren, Ohio.
5. "Oil as a Fuel under Boilers," by J. W. Gwynn, Bucyrus, Ohio.
6. "Carbureted Water Gas and its Advantages over Coal Gas," by Chas. R. Faben, Jr., Toledo, Ohio.
7. "The Lowest Price at which Gas can be Profitably Sold in Small Towns," by H. L. Hurlburt, Oberlin, Ohio.
8. "Fuel Gas: Results of Experience in its Manufacture, Distribution and Use," by Chas. H. Evans, Jackson, Mich.
9. "The Welsbach Burner as a Commercial Article," by Geo. W. Graeff, Jr., Philadelphia, Pa.
10. "Advantages of a Combined Coal and Water Gas Plant," by Geo. Light, Dayton, Ohio.
11. "Results of the Adoption of Electric Lighting by a Gas Company," by L. A. Strong, Mansfield, Ohio.
12. "Is the Supply of Natural Gas in the Ohio Valley Failing?" by Eugene Printz," Zanesville, Ohio.

In connection with the meeting there will be an exhibit of gas stoves, engines, burners, electric motors and any and all kinds of apparatus and appliances of interest to gas men and the lighting fraternity. A large room close to the place of meeting has been secured for this purpose, and the interims of the various sessions can be pleasantly and profitably spent in examining this display, which promises to be much more complete and interesting than the one shown at our last annual meeting.

In addition to this exhibit other objects of interest to members and visitors will be found in Mansfield's Electric Street Railway, the Gas Company's electric light works, and their new water gas plant.

The St. James Hotel will be the headquarters of our Association, where very reasonable terms have been secured for members and visitors in attendance at the meeting. The sessions will be held in a suitable hall in the block adjoining the St. James.

All members are again urged to attend this meeting prepared to participate in the discussion of papers read.

Persons eligible to membership, who are not already members, are cordially invited to be present and join our Association. Visitors from other States and Associations will be welcome.

Very respectfully, IRVIN BUTTERWORTH, Secy.

[Official Notice.]

Second Annual Meeting of the Southwestern Gas Association.

Fort Worth, Texas, Feb. 11, 1889.

The Second Annual Meeting of the South Western Gas Association will be held at Austin, Texas, Tuesday, March 19, 1889. It is earnestly requested that every member of the Association will make arrangements to be there. Matters of importance will come up for consideration, and a full attendance is desired.

There will be several interesting papers presented, and a good time generally is expected.

Austin is a city of especial interest to the fraternity, and in fact to everyone, being the central ray of that effulgent orb known as the Lone Star, Texas.

To those engaged in the gas business in Louisiana, Arkansas, Kansas, Colorado, New Mexico and Texas a cordial invitation is extended to join us and lend their aid and influence in the common cause—mutual improvement. This is not a Texas institution, but is designed to bring the gas men of the great South West into a union where they can compare experiences which are peculiar to our locality. Don't forget to come.

Thos. D. Miller, Secy.

BRIEFLY TOLD.

The Mansfield Programme.—We are in receipt of an advance copy of the programme arranged by Secretary Butterworth for the meeting this week at Mansfield of the Ohio Association. Perhaps at the outset we might better apologize for not having, in spelling "programme." omitted the final "me," as the Secretary has done; but since Webster has said it, we must follow that authority. The second "rare" thing on the card is an annotation of the fact that "Standard Time" is to be the guide for the opening hour of the convention; hence the members and guests must not trust altogether to their watches in determining the "westing" of time for the morning of March 20th. And these remarks are not advanced for the purpose of fault finding, but rather to show that it must needs require a very captious critic to detect a flaw in the card before us when these are the only items on which to even attempt to hang a tale of objection. Following the "Election of New Members," which concludes the initial routine business, comes President Woods' address; and in it we hope to be entertained by some recital of actual progress towards the glorious, if not altogether too sunshiny, season for the industry of artificial illumination and heating marked out by him in his paper of a year ago on "Our Future Prospects." It goes without saying, however, that what he will say shall be well told. The afternoon session, set for 1:30, promises to be one of the most entertaining of the meeting, for among the four paper writers who are to then make their bow we note the names of Chas. R. Faben, of Toledo, and of Herman Wilkiemeyer, of Portsmouth, the latter gentleman being the one who, representing Lancaster last year in the Association, gave to the fraternity a paper which for completeness and finish was nothing short of an intellectual treat. Since he has chosen this year to keep on with a description of the legal perplexities connected with the manufacture and sale of gas—for "Taxation" is certainly perplexing and encountered by all—we expect to note a repetition of his success of a year ago. The man from Toledo is nothing if not outspoken, and accordingly we know that what he will present in respect to "Carbureted Water Gas and Its Advantages over Coal Gas," will not require much reading between the lines to get at just what the writer intends to convey. Further, as Mr. F. is not given to the practice of attempting to deceive himself, we incline to the view that the record of the Toledo works in water gas will be the sole basis of his argument and judgment. At the evening session, to convene at 7:30, three papers are to be read, the best, in true epicurean policy, since it proves fair to be the most toothsome, having been reserved by the Secretary for the close of the evening's entertainment and instruction. The morsel alluded to is the paper by President Strong, of the Mansfield Company, on the "Results of the Adoption of Electric Lighting by a Gas Company." We hope, too, that the discussion on the paper may be permitted to enjoy a lasting embalming in printer's ink; for all the gas world, much as the majority would like to, cannot be in Mansfield on the night of the 20th. The morning session of the second day is to witness debate on four papers, all on live subjects, and by competent authors. We hope that Mr. Evans, of Jackson, Mich., will be able to at least report progress in the use and distribution of fuel gas at this point; although we submit that our accounts of the success of the Jackson experiment are far from reassuring. Routine business will take up a portion of the second afternoon, after which a visit to the gas and electric lighting plants of the local host will be in order; as also a formal inspection of the exhibits in connection with the display of gas apparatus that has been arranged for. We might here remark that the latter is sure to be most creditable to the Society and to exhibitors, and no small meed of thanks should be allotted to Supt. Harris for his tireless attention to the humdrum, often laborious details of preparing for the affair.

Death of Thomas Smith, Grand Rapids, Mich.—Turning aside from our congratulations over the prospect for a representative and successful gathering at Mansfield, Ohio, we are sharply reminded of the task which we are now sorrowfully compelled to assume in the announcement of the death of Thomas Smith, Superintendent of the works of the Grand Rapids Gas Company, and for years an honored and loved member of the Western Gas Association. Full of the merit that gathers from a long life well spent, he was called away early this month to share the reward of his well-spent life.

Deceased was born in Alloa, Scotland, on March 20, 1820, and came of a family that knew what it was to struggle with the world, but who never were cast down by its buffetings. Having received a common-school education, he selected the gas maker's craft as the particular field wherein to develop his talents and to expend his energy. Mastering the principles of the business, we soon find him in charge of the small gas plant at Tillicoultry, a beautiful Scotch town, on the Devon river, not over 4 miles away from his birthplace, and justly celebrated for its shawls and the plaidings so dear to the memory of Scotia's sons and daughters. Progressing in his business, and anxious for advancement, it was not long before Edinburgh attracted him, where his connection with the gas works lasted for some years. His ambition finally prompted him to visit America, and, with his wife (a Miss Ann Robertson, of Alloa), the journey to the "Western Empire" was made in 1854. In 1855 he was intrusted with the construction of the gas works at Adrian, Mich., which was followed by a like undertaking at Kalamazoo, Mich., in the following year. In 1856 he removed to Grand Rapids for the purpose of taking charge of the plant that now stands there as a strong and rugged monument to his ability, carefulness and zeal. For 10 years he was honored by his fellow-townsmen in their selection of him as a Councilman; and less reproach would be accorded such bodies did they oftener contain a leavening of men of the Smith type and caliber. He had been President of the local St. Andrew Society, and of the Burns Club as well, for a number of terms, and while thus honoring the memory of his native land, he was nevertheless as sterling an American citizen as it was possible to be. About a year ago he contracted a cold that finally assumed a dangerous phase, and towards the close of this winter journeyed to Pueblo, Colorado, in the hope that buoys many to turn their faces temporarily from home. Nature, however, refused to relent, and the end came. He was buried, on March 10th, from the Park Congregational Church, Grand Rapids, and the occasion was seized to emphasize the affection and grief of his friends and the people. His widow and two children—Jno. R., of Pueblo, Col., and a daughter—survive to keep green the memory of a husband and a father in the truest and best sense that these terms imply.

Honest, capable and unassuming, in his death the Grand Rapids Company loses an efficient officer, and the fraternity a valued co-worker.

The following contract has been arranged between the authorities of Newton, Mass., and the Newton and Watertown Gas Light Company for the public lighting of Newton during the next three years: 72 arc lights, 1,200 candle power, to burn from sunset to sunrise, at $100 each per year; 450 incandescents, 25-candle power, to burn from sunset until 12:30 A.M., at $13.50 per year; 715 gas lights, to burn from sunset until midnight, at $12 each per year for 4-ft. burners, and $14 each for 6-ft. burners; and 50 kerosene lights, to be lighted from sunset to sunrise, at $10.50 each. All to be lighted 20 nights each month, as per moon schedule, and on such other stormy and dark nights as directed by the city marshal or street light committee.

Athens, Tenn., may have a gas works, the enterprise having originated with Chattanooga capitalists.

The electric light company at Wilmington, Del., manages to earn a 6 per cent. dividend, even though Brother Curley sells gas at $1.25 per 1,000.

The Poughkeepsie (N. Y.) Gas Light Company proposes to engage in the fuel gas business.

Continued from p. 309.

[Official Report—Revised by the Secretary.]

Nineteenth Annual Meeting, New England Association of Gas Engineers.

Held at Young's Hotel, Boston, Mass., February 20 and 21, 1889.

First Day—Wednesday, Feb. 20—Afternoon Session.

Mr. C. F. Prichard (Lynn, Mass.) from the Special Committee on "Photometric Standards," then read the following report respecting the results of his and Mr. Taber's researches:

PHOTOMETRIC STANDARDS.

As a result of some discussion which took place before this Association two years ago upon the relative values of the light emitted by the various kinds of artificial illuminants, this Committee was appointed to devote such time as was in their power to the work of photometry, and to report upon what was being done.

Their time being well occupied by their regular work it, of course, was impossible to go exhaustively into the subject, or to make any such extended series of observations as are made in the photometer rooms abroad, and we have, therefore, only investigated the proposed standards, and tested that which appeared on investigation to be the best.

It was hoped in the beginning that we might be able to investigate the different kinds of light, and, if possible, find out the cause and amount of the discrepancy which apparently exists between the candle power, as measured by the bar photometer and the actual illuminating value of the light, particularly when different kinds of light were compared, as gas and electric light. Our earliest attempts at this, however, met defeat at the hands of the standard candle, and we found that before we could compare different lights it was necessary to have a better and more definite standard; for we found that results obtained at different places with candles as a standard were liable to be very contradictory.

Much has been said and written upon the many imperfections of the candle, as well as upon its advantages—for it has some; and in our report of last year Mr. Taber gave the results of extended experiments in his laboratory upon this subject, therefore it is not worth while going into it here. The fact seems to be that we have progressed beyond it as a unit. Its inaccuracy is not doubted, and in these days of keen competition of the various lighting agents accuracy is demanded.

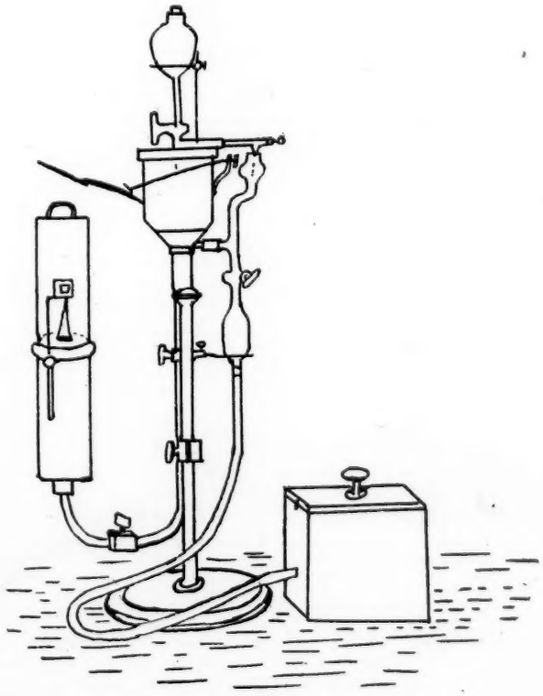


Fig. 1.

It is probable that the average of a series of observations made with several changes of candles, or even one candle which had shown itself to be all right, would not be far from the truth, but as there are many times in our strife for progress when we wish for quick and accurate indications of candle power, we cannot maintain the experimental conditions long enough for several tests, and we have lost faith in a single test for candle power.

We are not able with the candle to measure light with sufficient accuracy and certainty to compare results obtained in different cities where the results are at all close; for the candle used there is very liable to

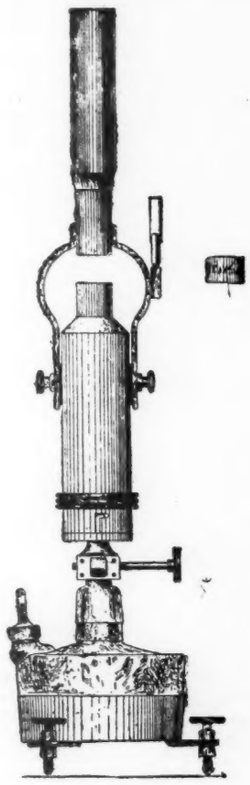


Fig. 2.

vary from that used here. Of what value, for instance, is it that two similar works experiment in running with different kinds of oil or coal, and obtain a result showing one method to give 3 per cent. better results than the other, if the illuminating power has been obtained by different candles? In such cases the test must be long enough to obtain an average result if we wish to approach accuracy.

The days of improvements in gas making which produced a gain in illuminating power visible to the eye have gone by, and the exact amount of benefit of the smaller improvements needs to be measured by a more accurate unit of light, if we wish to make certain progress.

To a limited extent, the composition of a gas lies in the engineer's power. With a high heat he can increase the amount of hydrogen, at the expense of the marsh gas; the amount of illuminants, CO_2, O, and N, he can also command to a large extent. To obtain the best results, both in accuracy and candle power, he is desirous of knowing the various mixtures, but if the standard varies several per cent., the analysis of gas with the candle power taken at different times at different places with different candles became of doubtful value.

Take, for example, three samples of gas as given in the State Inspector's report. The analysis and tests are undoubtedly as accurate and as reliable as any we can get, yet the results are not only at variance with each other, but contrary to what we might expect.

The samples are all of coal gas, enriched with oil, and some of the discrepancy is undoubtedly due to the inaccuracy of the test for illuminants; but after allowing for this, in gases which are of similar manufacture, it seems as if there must still be error in the determination of candle power.

Ill.	CH_4.	H.	CO.	N.	O.	CO_2.	C.P.
6.20	36.98	47.89	7.56	1.14	0.00	.23	17.4
6.19	35.77	43.39	6.70	1.37	0.03	.55	18.6
4.64	35.97	51.06	7.02	1.36	0.00	.23	17.4

Comparing the first and second, chemical knowledge says they should

be of substantially the same candle power. The photometer shows a great difference.

Comparing the first and third, the photometer shows them to be of the same candle power, while their chemical composition would indicate them to be very different.

As gas sellers it is also an extremely practical matter whether the Inspector finds your 18-candle power gas to be 18 candles, or whether his candle happens to be one of those at the other end of the average oscillation of error and makes it 17-candle; or again, that never-to-be-forgotten moment when he pronounces your 16.8-candle gas to be 18-candle.

I have dwelt upon the matter, for I fear many are inclined to think this is not a practical matter, but rather one of the laboratory, and I wish to impress upon you that it is an extremely practical matter to us both as manufacturers and as sellers. As manufacturers, the more exactly we know what results we are obtaining, and the more knowledge we have of our business the more progress we can make. As sellers we wish to know beyond a question that our standard of quality is always maintained.

In looking over the numerous lists of proposed standards of light two things are absolutely required.

1. That the material which is burned shall be one of practically unvarying composition, which is not affected in burning by wick or other apparatus.

2. That both material and device for burning shall be simple and capable of exact duplication at any place or time.

Applying these tests there remain but two of the proposed standards which approach our ideal—the pentane and the amyl-acetate. The Edgerton and Methven slots are extremely simple and convenient, and are capable of exactly similar reproduction; but if the combustible is common illuminating gas, it is of varying composition to a certain extent. We have, however, found them very useful and accurate when the gas used does not vary over one candle.

The amyl-acetate we have had no experience with as yet, but we get conflicting reports as to its candle power, while the varying quality admitted by the manufacturers is not assuring.

The pentane standard was shown here last year and now nearly fills the requirements. It produces an air gas, it has no wick or other arrangements to influence its flame, which issues from a circular hole at the top of a brass chamber, and the whole device being of fixed dimensions can be reproduced at will. Its burning matter is pentane, a product of the distillation of American petroleum; ordinary gasoline is treated with sulphuric acid and caustic soda to purify it, and then distilled several times at 50° C. The product is mostly pentane. It is impossible to produce a pure pentane by this process of fractional distillation, but the inventor of the Standard, Mr. Harcourt, states that pentane so distilled, having a specific gravity from 0.628 to 0.632, is suitable to use in the lamp, and will produce a flame whose power is always the same.

It is a perfectly easy matter for a chemist to produce any amount of pentane at reasonable prices, of the gravity called for.

That different people can produce a compound substantially the same is shown by the specific gravity of several samples which I have collected and tested. Their specific gravity was 0.629, 0.636, 0.637, 0.626; while some prepared at the Institute of Technology was 0.632. Some of these are first attempts at manufacture, which could easily be improved upon with more experience. They could not be told apart in color of liquid, in the flame produced, or in any way but by a slight smell of some which had not been purified, and a slight difference in photometric results of the two extremes, which will be shown.

Having now an apparatus based upon the foot rule, and burning a practically uniform chemical compound, it seems as if the results should be far better than those from the candle, as it has a smaller number of possible sources of error, and ought to give a uniform light.

The Pentane Standard Lamp No. 1 (shown last year) was rightly criticized on account of its many details, the liability of the glass work becoming broken, and the skill and practice needed in handling it to obtain good results. It has been much simplified and improved upon during the year, and the Pentane Lamp No. 2, manufactured by Woodhouse & Rawson, kindly loaned me for your inspection by Mr. Geo. S. Page, is the result. As you see, it resembles an ordinary lamp with a naked flame which is steadied by the upward draft from the chimney above. It has a wick, but it does not burn, and approaches only to within 2 or 3 inches of the flame, serving to conduct the pentane by capilarity to the tube where it is vaporized by the heat conducted downward from the flame, and burns on, issuing from the circular hole on top. The height of flame is regulated by the screw, just as in an ordinary lamp. Its flame is screened at top and bottom by the chimney, and it thus has combined with it some of the advantages of the Edgerton and Methven screen. By raising or lowering the upper part of the chimney a light of different power can be given, the amount of which is regulated by a set of gauges.

During the past year the Association standard was loaned the Institute of Technology; and as illustrating the results which can be obtained from the use of pentane in the older form of lamp, I wish to call your attention to a series of experiments made by Messrs. Pearson and Hathaway (of the class of 1888), taken from their graduating thesis, which was kindly loaned me by Prof. C. R. Cross. Their experiments called for the making of some 2,500 recorded observations, and are a model of painstaking work and careful observation.

Having an exactly similar Harcourt lamp at the Institute, their first experiment was to compare them together, and the summary of the result obtained is shown in the following tables, in which the Association lamp is taken as the standard, and the other expressed in terms of it, with the average deviation of candle power and the percentage.

Harcourt vs. Harcourt.

	Number of Observations.	Illuminating Power.	Deviations of Illum. Power from Mean.	Per cent. of average Deviation of Illum. Power.
	25	1.021	0.014	1.37
	25	1.017	0.016	1.57
	50	1.008	0.009	0.89
	50	1.014	0.011	1.08
	50	1.016	0.008	0.78
	50	1.034	0.008	0.74
	50	1.028	0.010	0.99
	50	1.011	0.012	1.16
	50	1.018	0.019	0.87
Mean....	400	1.019	0.012	1.05

Same Lamps Reversed.

	Number of Observations.	Illuminating Power.	Deviations of Illum Power from Mean.	Per cent. of average Deviation of Illum. Power.
	50	1.051	0.012	1.01
	50	1.056	0.007	1.61
	50	1.053	0.008	0.73
	50	1.055	0.007	0.70
	50	1.055	0.005	0.51
	50	1.055	0.006	0.54
	50	1.057	0.005	0.51
	50	1.050	0.006	0.61
	50	1.056	0.005	0.48
Mean....	450	1.052	0.007	0.74

Association Harcourt vs. Candle A.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	1.081	0.030	2.77
	50	1.111	0.016	1.41
	50	1.085	0.014	1.24
	50	1.015	0.012	1.11
Mean....	200	1.073	0.018	1.63

Association Harcourt vs. Candle B.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	1.083	0.012	1.06
	50	1.108	0.012	1.07
	50	1.074	0.011	0.97
	50	1.054	0.015	1.38
Mean....	2.00	1.080	0.012	1.12

Association Harcourt vs. Methven, Long Slot.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	2.121	0.016	0.78
	50	2.151	0.019	0.86
Mean....	100	2.136	0.017	0.82

Association Harcourt vs. Methven, Short Slot.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	2.023	0.010	0.48
	50	2.008	0.020	0.99
Mean....	100	2.015	0.015	0.73

Institute Harcourt vs. Methven, Long Slot.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	1.836	0.009	0.51
	50	1.879	0.011	0.57
Mean....	100	1.857	0.010	0.54

Institute Harcourt vs. Methven, Short Slot.

	Number of Observations.	Illuminating Power.	Deviation of Illuminating Power.	Per cent. of Deviation.
	50	1.907	0.011	0.55
	50	1.942	0.011	0.56
Mean....	100	1.924	0.011	0.555

We notice, first, that the lamps are not alike in illuminating power, one series of comparisons making the Institute lamp equal to 1.02 times the Association lamp, while with the lamps reversed it was 1.05 times. The writers state they could find no reasons why the results differed. The results are very close, the illuminating power varying only about $\frac{1}{100}$ of a candle, and the average of 950 observations being only $\frac{89}{100}$ of 1 per cent. from the mean.

In the second and third tables the Association lamp was compared with two different candles, and we notice at once the increase in deviation of the readings, and the increase of the percentage of average deviation, which rises to 1.37 per cent. The fact is also shown that the candle power of the Standard is probably in excess of the standard candle, since it equals 1.073 and 1.08. of the standard candles used.

In the third and fourth tables the Association Standard is compared with the Methven slot. The light emitted from these we would expect to find more constant, and the deviation reduced, which is so, the average per cent. of deviation becoming only 0.77, while in the fifth and sixth tables, where the comparison is made of the Institute Standard with the Methven, the per cent. of average deviation is only 0.55. That the two standards are not alike is shown by the comparison made with the Methven, which was 2.06 with the Association Standard and 1.96 with the Institute Standard.

Constancy of Flame.

The new pentane lamp was received only a short time ago, and it was impossible to make all the tests desired with it. The flame given by it is perfectly steady, and in an ordinary photometer room looks like a painted band of light. Jars or vibrations affect it only for the moment, and those imperceptible draughts of air which cause a candle tip to reach from side to side did not affect it at all. In the short experience I have had with it I find it far steadier than the older lamp, which has a disagreeable habit of streaming up at times.

To test the constancy of the flame it was set against a Methven slot, burning a uniform gas from a large holder. Forty observations were taken during an hour's test, the average difference of the readings being only $\frac{1}{100}$ of a candle, and of the 40 observations only 3 varied over 1 per cent. from the mean. The constancy of the flame can also be judged of from any of the other tests.

Power of Flame.

While the size of the flame shown to the disc can be regulated at will, it was a matter of interest to see if the standard as actually given us was equal to our standard candles. To ascertain this it was tested against two imported standard candles, with the following results:

Candle.	Number of Observations.	Time.	Average (corrected) Candle Power of Standard.
A	25	20	1.12
A	12	10	1.10
B	29	20	1.13
B	12	10	1.09
			1.11 (Mean.)

Showing the standard to be in excess, which had been suspected before from other tests.

Comparison of Standards.

A direct test was also made to see what relation the standards which were in my possession bore to each other; for this purpose they were placed side by side at one end of a bar photometer and thoroughly and carefully screened from each other and the disc. At the other end was a Methven slot, against which they were compared with alternate readings, removing each screen alternately, and revolving the entire bar about the Methven as a pivot until it was in line with each.

First Test, 20 Minutes Reading.		Second Test, 20 Minutes Reading.	
Old Lamp.	New Lamp.	Old Lamp.	New Lamp.
1.61	1.63	1.60	1.63
1.60	1.59	1.60	1.62
1.63	1.63	1.62	1.62
1.61	1.62	1.60	1.60
1.61	1.63	1.60	1.60
1.60	1.62	1.59	1.60
1.61		1.60.	1.59
....	....	1.60	1.59
....	....	1.61	1.60
....	....	1.59	1.61
....	....	1.60	1.60
....	....	1.61	1.60
....	....	1.60	....
....	....	1.62	....
Mean 1.61	1.62	1.603	1.605

Variations Caused by Different Samples of Pentane Burned in the Lamp.

The lamp was set for 1½-candle power, and was compared with a Methven slot, the gas being drawn from a 150 M. holder, into which no gas had been run for 8 hours, which it is thought gave a perfectly constant flame for comparison.

The pentane used in the first test was the result of a first attempt at making it; it was not purified, and had a specific gravity of 0.637, the highest of any sample. That used in the second test was some given me by Mr. George Shepard Page, and, I think, came with the lamp from England. Its specific gravity was 0.629, the lowest of any sample.

	Number of Observations.	Time.	Average Candle Power.	Average Deviation.	Greatest Deviation.	Number within 1 p.ct. of Mean.
1st test....	25	30 min.	.819	.0047	.014	23
2d test	25	30 "	.858	.0037	.008	All

Care was taken in the second set to have the tip of the flame in the exact center of the slot, which may account for the greater accuracy of the readings.

Assuming that the results given by the second test are the right ones, as they are made with the best pentane, the table shows that using a pentane with a higher gravity of .005 than is allowed affected the result $\frac{33}{1000}$ of a candle, or about 4½ per cent. of the measured light.

It is interesting to note that at the Institute of Technology the Association Standard gave a candle power of 1.08 candles. It was taken down, set up at Lynn with different pentane, found to be like the pentane-lamp No. 2, which in turn was tested against different candles, and the candle power found to be 1.11, or a variation of only $\frac{3}{100}$ candles in all the tests with different pentane and different candles.

In conclusion it may be said that the newer lamp in my hands has been extremely convenient to use, more so than the ordinary candle, since there was no trimming or weighing necessary, and it can be adjusted quite as quickly. It is more accurate than the candle, appears quite as accurate as the older form of standard, and is much more convenient. Whether or not the difference of composition of pentane of substantially the same specific gravity will affect the results is still a point in doubt, although Mr. Harcourt states it will not; and these tests seem to indicate that it will not appreciably.

Discussion.

The President—Mr. Goodwin has had a good deal of experience in this matter, and can doubtless give us some information.

Mr. Goodwin—Whenever I have anything to say it unfortunately brings in the "shop" almost too conspicuously. As a manufacturer of photometers I may say that since the introduction of the electric light there has been a great demand for these instruments, and the question is being constantly asked me, "Which is the best standard?" I think that in the last two years I have been called on for something like 24 instruments. I mention that as an indication of the desire to test gas against the electric light. The question of a standard is an important one. I have endeavored to secure the best standards that can be made, and I think there are none so reliable as the Edgerton chimney with the Methven slot. From what has been said about the lamps which are before you it seems to me that either of those is far superior to the candle. It is almost impossible to get a set of candles that you can thoroughly depend upon. I give you that as the experience of one who has had a great deal to do with the matter, and it has given me a great deal of trouble to answer the questions. From what has been said here this afternoon it seems to me that the lamp which has been exhibited meets

all the requirements better than anything else I have yet seen. I give that as my judgment from what I have seen and heard this afternoon.

Mr. Prichard—The Edgerton slot that Mr. Goodwin speaks about is made by the American Meter Company, and is a very handy instrument indeed. It is as accurate as anything can be where the gas burned does not vary over one candle.

Mr. Cabot—I move that a vote of thanks be given to Mr. Prichard and the Committee for his interesting report and their joint labor. (Adopted.)

ELECTION OF OFFICERS.

Mr. Slater, of the Committee appointed to nominate officers for the ensuing year, reported the following nominations:

President—R. B. Taber.

Vice-Presidents—C. F. Prichard, H. A. Allyn.

Secretary and Treasurer—C. H. Nettleton.

Directors—H. B. Leach, W. A. Wood, Z. M. Jenks, E. C. Jones, J. L. Hallett.

Mr. Slater—Perhaps I ought to add for the information of members that the reason the Committee departed from the usual custom of renominating the President for a second term was because we were informed that President Norton would positively decline re-election.

On motion of Mr. Neal the report of the Committee was accepted.

On motion of Mr. Coggshall, the ballot of the Association was cast by Mr. Slater for the nominees of the Committee; and they were thereupon declared duly elected as officers of the Association for the ensuing year.

INTRODUCING THE PRESIDENT-ELECT.

The President—Gentlemen of the Association, allow me to present to you Mr. Robert B. Taber, of New Bedford, Mass., whom you have chosen for your President for the ensuing year.

RESPONSE OF MR. TABER.

Mr. Taber—Gentlemen, I really think this is too bad! I would not sit here this afternoon had I thought you would put this on me. I had confidently expected that Mr. Norton, who has so well filled the chair, would continue to fill it. I told him this noontime that he was the best man for the place, not knowing anything about your intention to put me in the office. I think that you have made a mistake in doing so. But seriously, if you really mean business, I will do the best I can. A few years ago I got a fright about our gas business. I thought then (perhaps in common with some of you) that we were going to be left behind in our competition with others for the supply of illumination and fuel to the citizens of our communities. But I have changed my mind since then. I have had a good deal to do, in the past year, with something which is not perhaps just in the line of what a good, straightforward gas man should do; but I see to-day a vast deal more of uses for gas, and a vast deal more for gas men to do than ever before. And I could not help thinking, while listening to Prof. Norton's lecture this afternoon, that there is a vast deal more that we have got to learn in order to do what is waiting for us to do. Our united efforts are needed to put and keep the gas business where it ought to be—not only as a successful competitor among illuminators, but also for the good of the communities we represent. We all know that the increased sales by gas companies during the past year are not solely due to the dark weather of last November, but were largely owing to our own efforts not only in making better gas but in reducing the price and in extending its use. I have been very much pleased to-day with the thoroughly practical character of the papers which have been read. They will help us all to take with us some thoughts to work out at our homes.

With such a good staff of men to work with, and hoping for the cordial co-operation of all the members, I will do my utmost to keep you from regretting your choice of me as your President for the coming year.

The Association then adjourned until 10 A.M of the following morning.

SECOND DAY—FEB. 21—MORNING SESSION.

The Association met at 10 A.M.

The Secretary read the following letter:

TOPEKA, KANSAS, Feb. 17, 1889.

CHAS. H. NETTLETON—DEAR SIR:—I have just received a letter from Col. Holliday, President of our Company, suggesting that I make a trip for the purpose of investigating several matters in our line of business—among them a wonderful process of gas making, by means of which, according to report, a fine article of illuminating gas is being made in Boston at a cost of less than 5 cents per thousand, and a good article of heating gas at a cost of 3 cents per thousand. The illuminating article is said to be the same as the other, except that it is "more thoroughly purified." Are we asleep? Here is a man right under our noses making gas for $1.43 *per ton*, if it is water gas, and 82 *cents per ton* if it is producer gas.

"*Quosque tandem*, O, process fakir! *abutere patientia nostra!*" The colored gentleman was able to sell his brooms cheaper than his competitor for the reason that he stole them ready made, whereas his rival could steal only the materials. Here is a question for the New England Association of Gas Engineers to solve: Does the man steal only the materials, or does he steal the gas already made? Or has he, like the lady in Illinois, got an electric battery in each retort?

I have told you all I know about the matter. I don't know the name of the inventor of the "process," or that of the "promoter of the enterprise."

I would much like to get ready in time to attend your meeting, but it is impossible. The paper by Mr. Jones and the report of Mr. Prichard would be especially interesting to me.

With my best wishes for the continued success of your Association, and with the hope that we will have the pleasure of seeing more than the usual number of your members at our next meeting at Cincinnati.

I remain, yours truly, B. E. CHOLLAR.

Mr. Harbison—I wish that Mr. Wood would tell us about the gas made in Boston by this process. That is too important a matter to be passed over with the simple reading of the letter.

Mr. Wood—I have heard of it, and understand that it is burned in an ordinary cooking stove.

Mr. Leach—I think Mr. Allyn can enlighten us, as I understand that the process is being carried on in a back yard, very near the Cambridge gas works.

The President—Mr. Allyn [who has just come in], the members want to know how to make gas at 5 cents per thousand.

Mr. Allyn—That is just what I want to find out.

The President—I think Mr. Prichard knows something about it.

Mr. Prichard—I suppose what is meant is the experiment at Cambridgeport. The first part of the apparatus is an air pump. They take air and force it through some 12 or 15 cylinders. The gentleman who explained the process said that there was a certain amount of oil put in all these cylinders; that in the first cylinder the air became filled with a vapor; in the second chamber it became a mechanical admixture; and that in the third it became a chemical mixture. All this was accomplished without any heat. The contents of the apparatus were not divulged, although it was said that there was nothing in it but steel, iron, and copper, and that the gas passed on from that apparatus directly into the holder. That is the process for making heating gas. When they wished to produce illuminating gas they simply passed the air through the same cylinders, and then through a coil of pipe which was heated red hot. As near as I could judge they made, in the first instance, what the Springfield gas machine would make; and, in the second, what the old Rand process would make. They had two holders there, and a 100-light meter. They passed the gas through the meter with considerable velocity.

Mr. Thomas—Something over two years ago I went to Ohio to investigate this process, which was then called the Johnson process. They took a barrel of oil and forced air through it, in the way Mr. Prichard has described, and from the residuum that was left they made a very fine lubricant. The claim was made that they could sell the lubricant for a little more than the oil cost, and they would still have the barrel left. (Laughter.) They brought the process to Boston; and two years ago (when I was here at the 1887 meeting) they invited me to go and see it. Professor Norton (who spoke here yesterday) worked on it, and made some reports with regard to it, showing the cheapness of the manufacture. I would not like to put out those reports now, but may at some future time. It seemed that by the process, worked in that way, a small quantity of gas could be made much cheaper in proportion than a large quantity, thus upsetting the old theory that by increasing a product we lower the cost. I had to give the matter up last year, being unwell, and have not attended to it since. The gentlemen who are interested in the process in New York and Boston are heavy capitalists, and have expended a good deal of money in experimenting with it.

Mr. F. C. Sherman, of New Haven, Conn., read the following paper, entitled

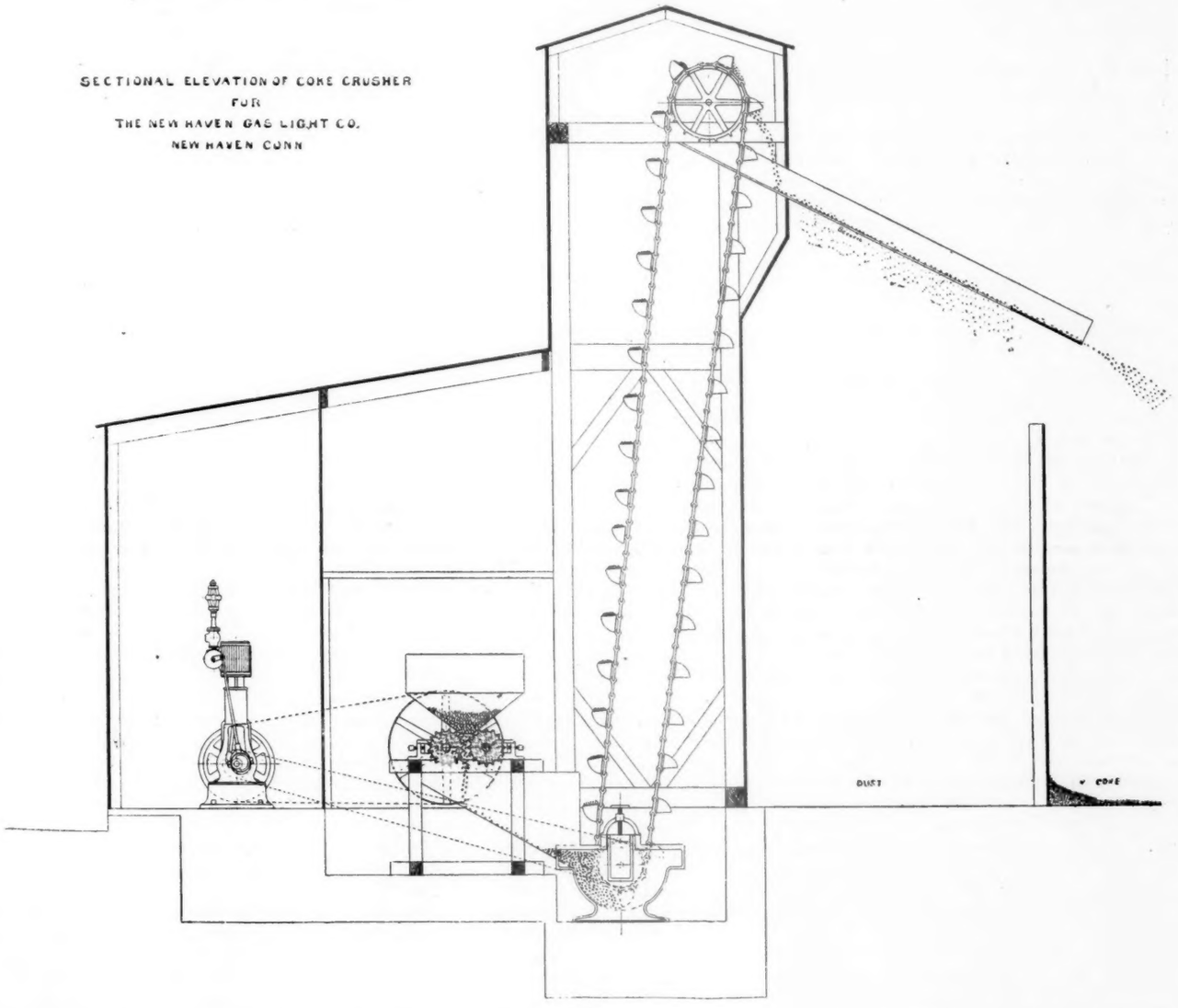
BREAKING COKE.

I am requested by our Secretary to give my experience in the use of a coke crusher. The sale of coke, although a commercial question, is one to which too little attention is given by the directors of gas companies. The often overworked manager has no time to give to this department, and the return from this residual is far below what it should or would be if carried on under other commercial principles. In fact, I believe it

would be a good investment for any gas company carbonizing 12,000 tons of coal per annum to employ a competent man to take charge of this department.

The successful working of a gas works depends in no small degree upon finding a good market for the residual products, and especially for coke. The universal demand for lower rates for gas during the last two years calls for greater economies in our working, and therefore the best possible results obtainable from our residuals. A gas manager cannot influence the value of tar or ammoniacal liquor, but I hold he can influence the value of coke by his ingenuity and commercial activity.

The gas companies that advertise their coke in the daily papers, calling attention to its value and economy as fuel, are the grand exceptions; and as people in other branches of trade find it necessary and to their advantage to advertise their goods, why not let the public know that we have coke for sale? and to prove to them at the price at which it is offered it is cheaper fuel than coal. Besides, no gas company ever lost by being on friendly terms with the press. Every gas manager knows that, weight for weight, a pound of coke will evaporate more water than the best coal; but how many of his customers who use steam know this fact? And who is to blame that they do not know it? We all have heard the objection that coke injures the iron and brickwork of boilers. My answer to that is an invitation to examine the boilers at our gas works, which have been fired with coke day and night for 15 years. I also request my coke customers to deduct from their monthly bills any damage they may find in the use of coke for firing boilers. I have never had to make any deductions on that score. Many a manager when calling the attention of his board to the saving of coke that would be accomplished by using regenerative furnaces has been met by the objection that the coke saved could not be sold. I hold that such an answer carries on the face of it evidence of lack of ordinary commercial activity in the disposal of the coke, and is a reproach to the management. It can be disposed of at rates that will compare favorably with the price of coal in any given place; but it cannot be done by methods of doing business in vogue 40 years ago, and still adhered to in too many gas companies of to-day, of waiting for the customers to come to you. That kind of management in the sale of gas or coke is bound to get badly left, and must give place to the same push and energy that are displayed in other branches of business which are carried on successfully. Coke is often sold to distant consumers at largely reduced rates in order to keep up the price in the locality where it is produced. Our price for coke has been badly cut in the past by this competition; but the policy of this appears to me to be very questionable. If a gas company has any coke to give away or to sell at reduced rates it would seem desirable to give the gas consumers of the place where the coke is made the benefit of the gift or lowest rates, instead of awarding that benefit to the carriers. There should be a uniform selling price, regulated according to the quantity taken and the distance of delivery. The price should be made such as will prevent a large accumulation of stock, and sufficiently elastic to take in wide variations in the price of coal, which is the crucial test of our prices. The price of coke for domestic use, pound for pound with the best coal, must be kept at one-fifth lower rates in order to overcome the prejudice existing against coke on account of its extra bulk as compared with coal. Any extraordinary rise in the price of coal must be followed by a corresponding rise in coke in order that a reduction in price can be made when the price of coal falls to its normal state. The consumer expects that the ordinary laws of trade will obtain in the



coke business, and any attempt to exact a cast iron price will be followed by dissatisfaction and loss of trade.

The sooner coke is disposed of after it is drawn from the retorts the larger will be the return from it in measurement. I estimate that the loss in bulk and the cost of labor in stacking coke is equivalent to two cents a bushel. The great drawback against the use of coke (for domestic purposes) as it comes from our retorts is the size of the lumps, and unless a gas company reduces these lumps to a size that will compare favorably with stove coal, it may as well abandon at once any hope of obtaining a house trade, and must be content to put its product in competition with steam coal at cargo prices. A few companies have for customers manufacturers who must have coke for other than steam purposes. We formerly had one who took all our spare product, at good prices, for heating mufflers, but he has discarded coke for coal. The house trade, besides being the most reliable and realizing the best prices, should be sedulously cultivated. The customs of the coal trade in the place, in regard to delivery and burning, should be followed; pleasant office service, reliable and courteous drivers employed; in fact the business should be carried on on commercial principles. I have here an illustration of a coke breaker which has been in use for several months at the New Haven gas works that has been found very efficient. It is made by C. M. Keller, of Columbus, Ind. The apparatus can be adjusted to break the lumps into various sizes, and in operation makes very little breeze. The machine is placed so that the hopper comes three feet from the ground. This saves labor in handling the coke. An endless link belt arrangement, drawn by the engine that works the breaker, elevates the broken coke 15 feet, where it passes over a screen separating the breeze from the coke. This elevation enables the broken coke to spread out on the ground without requiring to be shoveled away. A breaker and elevator, worked by a four-horse power upright engine, will break all the coke that six men can shovel into it. The elevator link belt arrangement cost $160, the breaker $130, the engine $150; other expenses, including a building over the apparatus, $100. One hundred bushels small coke, when broken to the size we are selling, give 85 bushels broken coke and two bushels dust.

I am well aware that I have said nothing new; nothing but what has been said better by others who have gone over the same ground before me, and many of you have been successfully practicing for years what I here recommend; but as I see the large piles of coke in many gas companies' yards—see it being shoveled over twice and sometimes three times—see it being delivered for house use unbroken and the water from it wetting the sidewalk, I can only conclude there is room for improvement in the way of handling the coke trade in many places. With all that has been said on this subject the companies that break their coke for domestic use are the exceptions.

Broken coke has been sold by my Company for the last 14 years. Our sales of it last year equaled 40 per cent. of our total sales. Our prices are 8 cents a bushel for unbroken, and 10 cents a bushel for broken. We deliver a chaldron of broken coke, weighing 1,700 pounds, for $4. The price of stove coal ranges from $5.25 to $6.25 per ton in New Haven. Our price per net ton would be $4.70, delivered. Only servants and parties coming with orders for coke from the overseers of the poor complain or fail to see the economy of using coke at the above prices.

Discussion.

Mr. Allyn—Will Mr. Sherman state what he estimates to be the cost per bushel for crushing and screening coke?

Mr. Sherman—As I say in the paper, the machine will break all that six men can shovel into it. It seems to be not very costly. I have not estimated the exact cost, but it is amply covered by the advanced price paid for the coke. We sell our unbroken coke for 8 cents, and the broken for 10 cents. The 2 cents difference in price more than covers the depreciation in volume and the labor of breaking it. We broke our coke for years (until we got this coke breaker) by hammers.

Mr. Allyn—Do you find a ready market for the breeze?

Mr. Sherman—We cannot supply the demand for the breeze. We get $1.25 per ton for it.

Mr. W. A. Wood—Have you been getting those prices this winter?

Mr. Sherman—Yes.

Mr. Jones—Do you sell your entire product?

Mr. Sherman—Yes; and we could sell a good deal more than we make. We stack enough in the winter to carry us through the summer months.

Mr. Nettleton—This is a matter in which I take a good deal of interest. Some years ago I went through the experience of having a surplus, and being obliged to send coke out of town in order to keep up the price in town. The experience was unsatisfactory, as the prices received were low. The consumption of gas has grown for years, and the amount of coke to be sold has increased every year very rapidly, not only because of the increase in the quantity of coal carbonized, but also by reason of the adoption of improved furnaces, which enable us to save fully one-half the coke which we were formerly using. Two or three years ago it became evident that I had got to seek some other form of trade than the factories which then used nearly all the coke sold, and I decided to try house trade. Perhaps the result is best shown by a statement of the number of orders received at the office. Previous to seeking the house trade we received less than 300 orders for coke in the year. One year after seeking it we had received 1,750 orders; and for the present year the number will be nearly 3,000. The quantity of broken coke sold in former years would be perhaps 2,000 bushels; for the first year after seeking the house trade we sold 18,000 bushels; and for this year 30,000 bushels will be sold. As the result of seeking this house trade we have been able to obtain 9 cents per bushel in the yard, free of the cost of delivery. We have not at any time during the last fall had 1,000 bushels of coke on hand, and we have been sending out during week days, through December, January, and February, 400 to 500 bushels per day. I have made some figures with regard to the cost of breaking coke by the Keller machine, as follows:

200 bushels large coke, at 9 cents		$18.00
When broken produced—		
164 bushels small coke, at 11 cents	$18.04	
9 bushels breeze, at 5 cents	.45	
	$18.49	
Labor in breaking and piling above quantity, 3 hours, at 17½ cents	.53	
		17.96
Loss on breaking 200 bushels of coke		.04

Practically the cost of breaking is 2 cents per bushel.

Mr. Slater—Mr. Cushing can give us some information on the point, as he has been breaking his coke for a number of years.

Mr. Cushing—I break my coke by hand. Our yard is concreted, and on that concrete floor all our coke is deposited by the men who wheel it out from the retort house. It is left there in whatever depth it will make, dumped from the barrows, until the men come along and break it with hammers. After they break it, it is forked into baskets of two bushels each. Those baskets are loaded on wagons and carried out to customers. Thus we handle it only twice—once into the basket, and in the basket it is put into the wagon, and then carried into the consumer's house. Thus there is as little handling as can be done. That is our general way of disposing of our coke. Of course when we do not have customers enough at any one time, we have to pile it up, and that is a little more expensive. I tried the experiment of crushing with a steam engine we had, which cost us nothing and the steam cost us nothing. It was simply an experiment. I put the requisite number of men at work on the steam engine, with the crusher; and I also put one man at work with his hammer, outside on the pile, as we usually crush it, and found that he could beat the engine six times over.

The President—What crusher did you use?

Mr. Cushing—I do not recollect.

Mr. Allyn—What price does Mr. Cushing get?

Mr. Cushing—We get $4, delivered, for broken.

Mr. Allyn—Do you sell by the ton?

Mr. Cushing—No; and that is not the proper way to sell coke, in my judgment.

The President—We get $3.50 per chaldron at the works, and we cannot supply the demand. That is very cheap, with coal running from $6.50 to $7.50.

Mr. Taber—When in Cleveland, a few years ago, I saw Mr. Hyde's plan for crushing coke, and I think it goes further than Mr. Sherman's. He runs the coke out from the retorts in cars, quenches it, and carries it up on an elevator 50 feet, where it is crushed and screened. It then runs down into bins to accommodate the different sizes, and from those bins it went into measuring tanks, holding 10, 18 and 36 bushels. The cart being underneath, the coke is run into it and taken away. He made the statement that his coke was never touched at all by hand. As to the breeze, I only say that in our electric works we would rather have the breeze than the coke. I think it is a better article for steaming than coke. So that any one having a steam boiler and electric light plant need not be deterred from breaking the coke by any fear that he cannot get rid of the breeze.

The President—We use all our breeze under the boiler.

Mr. Hallett—What method does Mr. Sherman employ to get customers for his coke?

Mr. Sherman—I am ashamed to say that we have not employed any method.

Mr. Hallett—Do you advertise it?

Mr. Sherman—No. When I was in Worcester we kept a standing advertisement in every newspaper, and I always considered it the best investment we ever made. In New Haven we get rid of 40 per cent. of our coke through the house trade, and our price last year averaged 8 cents per bushel, which we considered a very good price. We have so large a trade now that we know just how we can place all our surplus coke. The steam people are all anxious to get it. Of course, we have to put it in competition with coal at cargo prices. I think that the house trade could be worked up so that with a reasonable amount of energy we could sell every bushel in New Haven to the house trade.

Mr. Coggshall—What does it cost Mr. Nettleton to deliver coke?

Mr. Nettleton—I am almost ashamed to tell the story again, as many of you have heard it before. When I first sought the house trade I sent out cards on which I quoted the prices at which coke would be delivered and binned on any floor of any building within one mile of the gas works. The prices were for two, three, four, five and up to 25 bushels. In doing that I took advantage of the tendency which exists among the poorer classes of people everywhere—to buy from hand to mouth—to buy in small quantities. The largest number of orders we have for any one quantity is for 7 bushels, which we deliver for $1. That allows 77 cents for the coke and 23 cents for the delivery. For two bushels we get 36 cents—which is 22 cents for the coke and 14 cents for delivery. For three bushels we get 50 cents—which is 33 for the coke and 17 for the delivery. You will naturally think (as I did) that the small orders would produce a loss on the cartage; but to my surprise, when we have the smallest orders, and plenty of them, the team makes the most money. An accurate account has been kept ever since we started—nearly two years ago—of the cost of maintaining our team, and of the amount of money received for cartage, and we find that there is a profit in it. It is rare that the team earns less than $3 per day; and in a number of cases $4.50 per day have been earned by one man and one horse in delivering coke in these small orders.

On motion of Mr. Hallett a vote of thanks was tendered to Mr. Sherman for his paper.

Mr. R. J. Monks, of Quincy, Mass., introduced his paper with the following remarks:

Although I have been a member of this Association for nearly 20 years, and an attendant at your meetings, I have, in almost every case, been a listener rather than a speaker, and for the reason that, as you gentlemen were devoting your energies to the work of practical gas making, it behooved me, as a student, to come here and listen. But I had the pleasure of listening to some remarks of the gentleman who is to preside over your deliberations for the coming year, and I fully coincide with him that there is room for all the known systems of lighting which have merit. And not only is there room for their present development, but room for their future growth. I also agree with him in the statement that it behooves those who are engaged in the gas industry to put forth their best efforts in all the departments connected with that industry. For that reason I have accepted the invitation of the Secretary to read the following very brief paper on

ARTISTIC ARTICLES USED IN CONNECTION WITH ARTIFICIAL LIGHTING.

The admiration of mankind for natural light has extended through all countries and throughout all the ages of the world's history. Among the ancients the sun was regarded as a god, and magnificent structures were reared in its honor. The traveler in Syria, as he wanders through the ruins of Baalbec, is impressed by the grandeur of the structures which existed there ages upon ages ago. Amid its temples and palaces, fountains and monuments, grander and more imposing than all else, rose the great temple of the sun. On the west end of the palace of the Incas in Peru was a mass of solid gold, on which was represented the sun's disc and his rays. When the rays of the morning sun shining in through the eastern portal, which was open, fell upon the mass of gold they were reflected with dazzling splendor. This honor and distinction shown to natural also extended to artificial light. The disciples of Zoroaster were directed to face some luminous object during their prayers, and when the heavenly bodies were obscured resorted to artificial light.

In front of the oracle in the temple of Soloman there were ten golden candlesticks, and as oracle flourished in the most remote ages and is of the highest antiquity, it seems safe to assert that artificial light of some kind was associated with it by those who sought responses direct from their deity.

The history of the fine arts is constantly associated with the production of artistic receptacles and conductors of artificial light. The original lamps of the ancients were, as a rule, made of sea shells or the skulls of animals. Among the Northern nations of antiquity stone boxes filled with fat, into which a wick was thrust, formed a lamp, which is still in use among the Esquimaux. As the fine arts made progress in Greece and Rome for a long time the skull and shell shape was retained, but the lamps were made either of clay or bronze, and among these are many examples of great beauty and cost.

The candelabra in the palaces of the emperors were generally of bronze or marble, but were sometimes made of gold, and were of great size and magnificently wrought. Some of the bronze and copper lanterns of ancient Persia and Arabia, on which an immense amount of time must have been expended in their construction, still challenge our admiration as works of art.

Among the priceless treasures brought to Rome by Titus, at the close of the Jewish war in the first century, was the famous seven-branched candlestick, which was among the spoils taken from the temple at Jerusalem. It was nearly the height of a man, and was made of massive gold. Josephus' account of it, and the representation of it on one of the piers of the arch of Titus, so nearly agree as to furnish an accurate idea of its size and beauty. On the pier it is represented as being borne on the shoulders of four men. The candlestick itself was kept in Rome until the flight of Maxentimus, in the fourth century. When defeated by the afterwards Emperor Constantine, Maxentimus fled, but not until he had ordered his followers to take with them the priceless treasure, which for nearly 300 years had graced the capital. While the men who had the charge of its removal were crossing the Miloian bridge, the candlestick, by accident, fell into the Tiber, and it has never been recovered.

Among the many beautiful works of art designed and executed during the Middle Ages may be mentioned the highly ornamented golden candlestick now in the Cluny collection at Paris, made in the twelfth century; the candlestick of copper, covered with encrusted enamel, in the British Museum, made in the thirteenth century; also a candlestick of most exquisite form, made of that wonderful French pottery, known as Henry II. ware, now in the Rothschild collection, of which ware less than 40 examples remain.

Succeeding the lamps of antiquity came the lamps for burning whale oil. The whale fishery seems to have originated with the Norwegians in the ninth century, but the lamps in which it was burned appear to have been of a primitive character until nearly the commencement of the present century. It is a singular fact that the great principles underlying about all our modern methods of producing and using artificial light were discovered quite near the year 1800.

It was in 1793 that a celebrated French chemist, named Lavosier, in a series of experiments, stumbled upon the process of making water gas. A few years later the Worms lamp, with its flat wick, and the Argand, with its round and hollow wick, both used so extensively at present, were invented. In 1802 William Murdock, a resident of Redruth, in Cornwall, lighted his extensive manufacturing establishment successfully with coal gas.

In 1808 Sir Humphrey Davy discovered and commented upon both the arc and incandescent electric light, and in 1821 natural gas was discovered and put to use for light at Fredonia, N. Y. But while these discoveries resulted in a wonderful growth of artificial lighting the artistic features of the articles used in connection with it rapidly declined. The oldest of our members still remember the awkward glass lamps in use in our childhood as a terror to all housekeepers. Occasionally one sees still in use the ponderous and gaudy gas fixtures of 20 years ago, but when these are removed they will hardly command the price of the metal of which they were made. The progress made within the last 10 or 12 years towards a revival of artistic articles is gratifying; but are we in the gas business keeping up with our acknowledged rivals—those engaged in the sale of petroleum and electric light? My humble opinion is we are not. And yet we have at present occasional examples of what is possible in the shape of artistic gas fixtures. The massive chandelier which hangs in Trinity Church, Boston, is fully in keeping with the noble and beautiful proportions and finish of the interior of that structure. In many a place of business, and in many humble homes, the gas fixtures are pleasing features; still, much remains to be accomplished, when we consider the beauty and variety of globes and shades used in electric lighting, and the taste displayed in fixtures and lamps intended for petroleum.

Regarding the use of gas, the community seem at last waking up to the fact, so well known to the gas fraternity, that chimneys and globes absorb much valuable light, and are realizing the true value of naked gas flames. This fact would lead us to conclude that artistic progress in future should largely apply to the fixtures rather than to globes, etc.

There are many small companies in New England which through their shop and jobbing business can influence customers to take some pains and expend perhaps a little more money than they intended doing in order to secure something graceful and artistic. Even in the larger companies their offices at least should be fitted with better and more pleasing fixtures than they at present contain. Their managers certainly try to educate their customers to use gas stoves and Lungren lamps and why not at least set a good example in artistic fixtures. A cheap and clumsy affair tends to degrade the substance the ancients held as sacred: but "a thing of beauty is a joy forever."

On the conclusion of his paper Mr. Monks further remarked:

From a very large collection, which I have exhibited on several occasions when delivering addresses at the Boston University on the general subject of the history of artificial lighting, I have selected a few articles to illustrate this particular branch of the subject, and after the meeting it may interest some of the members to look these things over.

This (indicating) is an antique Arabian lamp, and is of the period of Moorish art which prevailed before the coming of Mohammedism into Arabia; because, after Mohammedism appeared in Arabia the making of figures with animals' heads on human bodies was prohibited by their religion.

This is an antique Persian lantern; and when it was hung up at the rooms of the Electric Club a few weeks ago and lighted, and it appeared that this whole pattern was reproduced, after the room was darkened, all over the ceiling and walls, the members declared that, where the light was intended to be subordinate to the beauty of the fixture, there was nothing in modern fixtures for that purpose that was as elaborate and beautiful as this specimen.

This pair of candlesticks was made in Paris, from bronze, after ecclesiastical designs of the middle ages.

This little lamp is a Pompeian lamp, a present from my brother-in-law, Prof. Hempel, whose apparatus was shown here yesterday.

I have also recently seen a Lungren arrangement which is by far handsomer than anything I had seen before of that character. I believe that this matter is as worthy your attention, in a quiet way and as a subordinate question, as some of the other matters which have come before you.

On motion of Mr. Slater the thanks of the Association were voted to Mr. Monks for his paper and for his interesting exhibition of antique lamps.

Mr. S. G. Stiness (Pawtucket, R. I.) here read his paper entitled

GAS AND ELECTRICITY.

Mr. President and Gentlemen of the Association:—No apology is needed at the present day in presenting to an association of gas engineers a paper upon the kindred industries of artificial light—gas and electricity. When we remember that little more than a decade of years has passed since the electric light was presented to our view in all its crudeness and imperfection, and to-day the voltaic arc sheds its brightness over the civilized world, we need not be surprised that there is no topic at the present time receiving more attention than that of the means and cost of artificial illumination. But I enter upon the discussion of the subject of a combination between gas and electricity with feelings of diffidence, as an "Observer" has remarked that he "has particularly noticed among the fraternity that the gas men who are acknowledged as the best informed and most thoroughly experienced exhibit the least concern as to the electric light and its bearing on their business." But some who are in the consolidated line are consoled by the remembrance that Noah in his wisdom entered the ark, while the Scotchman, who "na thought it much of a shower," has been for ages lost to history.

As you are well aware, I have for many years advocated the combination of gas and electricity, and there are so many reasons for the combination, many of which have so often been presented, that they need not be repeated. But there are some questions of a practical nature which can now be answered from the standpoint of experience. In a paper of this character it would not be expected, nor would it be appropriate, to present a statement of cost of production of electric light, arc or incandescent, or the per cent. of profit to capital invested, as compared with the gas business. Such a statement can be obtained (as has been the rule of this Association for many years). The cost of production will vary in different localities, and the cost and distribution will also be governed by local circumstances and the progressive character of the citizens. Moreover, if the demand is limited and the electric light company is brought into direct competition with a powerful and well-established gas company, a rate must be fixed which will not be remunerative. I may remark, in passing, that in our particular case the demand is for the increase of both, and the good, old, reliable gas account maintains its usual healthy condition; while the other is so pleasing in its character that I would give utterance to the expression, "Go thou and do likewise."

There are two facts in connection with this subject that, even at the expense of being wearisome, I must repeat. First, we must respect the demands of the hour, for "the electric light has come to stay;" and, second, "the world moves." In regard to the latter, I sometimes feel that if those who are wearied by the expression were to be suspended in mid-air while the world rolled away, "they never would be missed."

As the demand of the hour is for more light and cheaper light, does not the record prove that this result can be accomplished by one corporation and a consolidation of interests? There are certain natural monopolies, which are and must be recognized by an intelligent public—gas and electric light companies being the most prominent. The duplication of capital by one company for the same object is the annihilation of the other. Competition between rival gas companies never has been, and competition between gas and electric light companies never will be, an accomplished fact. Is it not better and for the interest of all that the combination be made in infancy? For the old rule holds good to-day, "Where combination is possible competition is impossible." Therefore, will not all the interests of the public be best conserved by the combination and consolidation of artificial light companies under one corporation owned and controlled by the citizens of a town or city, dependent upon said town or city for its support, and under reasonable State and municipal rules and regulations? Upon this rock I stand. I am well aware that there are some theorists opposed to the combination, and who labor to prove that the panacea for all the ills of municipal life, and the relief of municipal taxation, lies in the direction of the establishment and maintenance by the city of a gas and electric light plant, in some cases only for municipal use.

While we may pardon the claims of enthusiastic inventors in regard to the electric light, we cannot pardon many of the claims which are made as to the cost of production, and per cent. of profit. *The electric light costs money.*

I was much surprised to read in the Boston *Journal* of Jan. 9th, 1889, the address delivered by Prof. Ely, of Baltimore, at the banquet of the Merchants' Association (on account of the position he took), upon the subject of "Natural Monopolies and Social Taxation." And the burden of his song was gas and electric combinations and the benefits to be derived from the municipal establishment of plants. His statements are so misleading in their character as to demand more than passing attention, and are in the same line with which we have been so long familiar. In speaking of the gas war in Baltimore, where gas sold at 50 cents per 1,000 (and now under consolidation at $1.25 per 1,000), which was the result of attempted competition by 6 companies, he says—and that I may not be misunderstood, I quote from the printed record:

"Our streets are full of gas mains. Now all these different plants and outlays must be paid for, and every time a consolidation takes place fixed charges and capital stock have both been increased. The result is, that it does not now appear to be a very profitable business to supply gas at $1.25 a 1,000, although it can be made and sold at a profit for 37 cents. I say it can be done, for it is done in the city of Philadelphia, parties supplying the city with gas at that rate."

Now, is not the natural inference to be drawn from this statement that gas is sold to the citizens of Philadelphia for 37 cents per 1,000, and that it should be sold to the citizens of other cities at that price, when he knew or should have known that that is the price of the manufactured article delivered into the holders of the Philadelphia Gas Company. But the most glaringly erroneous statement in support of his theory of municipal ownership of plants is in regard to the much quoted city of Dunkirk, N. Y. I quote again from the record:

"Dunkirk, N. Y., is supplying electric lights of 2,000-candle power each, I believe, for about 13 cents a night, whereas cities are paying private corporations from 40 cents to 65 cents; 65 cents is, I believe, your rate in Boston—just five times as much."

Also, extract from report of Oct. 1888:

"Average number of lights run during month, 55 arcs.

Total amount of coal used, 137,777 lbs., at $1.65 per ton	$113.55
No. of carbons used, 3,412, at $11 per M	38.28
Six gallons oil, at 90 cents	5.40
Five gallons oil, at 35 cents	1.75
Six globes, at $1	6.00
Ten carbon holders at 25 cents	2.50
Six brushes	6.00
Twenty lbs. waste	1.80
Amount paid for labor	50.00
Total	$225.28

"Total hours run, 364⅛.
"Cost to run 55 arc lights 1 hour, 62 cents.
"Cost to run 1 arc light 1 hour, 1⅛ cents."

The foreman had extra help after a storm, which accounts for the extra $5 for labor, and the globes were to replace broken ones. Five cents additional was allowed for coal per ton to cover waste. Now, what are the facts in this case, as regards the cost of lamp per hour and night, as given to him and by him to the public?

Where is the electric light plant located? In the water works. Where is the boiler located? In the water works. What furnishes the water for steam and other purposes? The water works. Where is the fireman? In the works. Where is the engineer? In the water works; and where is the superintendent, and where are all the tools and implements incident to the expense of an electric light plant, and which add to the cost of production in ANY CASE? Why, in the water works. He closes by saying, "Private parties cannot render the service so cheaply." To which I respond, "No;" nor can any honest municipality furnish electric light at any such figures. Such a statement as to the cost of electric light from an intelligent man I must call maliciously misleading; and the cost of electric lighting at Dunkirk, with fair charges and credit to the water department, would be nearer 26 cents than 13, which would increase the amount, as stated by Prof. Ely, very materially. Also, the inference to be drawn from his statement that Boston is paying five times as much as Dunkirk, is that the price of electric lights in Boston is an extortion. Now, I believe that the very taxes on a plant in Boston will equal if they do not exceed the cost of many items of expense in many places, while the distribution and maintenance of lines in Boston, as every intelligent engineer will know, is one of the largest items of expense. If any one doubts the statement, let him investigate for himself. Taxes, water rates, and distribution and maintenance of lines, are legitimate expenses, per lamp, per hour, and are the same in a private or municipal investment. "The address was attentively listened to, but elicited but little applause," proving educated Boston's toleration.

I will now answer some of the practical questions which may be asked. Is the furnishing of electric light in connection with gas a paying business? If I were to answer in general, I should say, "Fairly well." Were I to answer in comparison with gas, I should say, "Could you expect an industry yet in its infancy to be as remunerative as an old, well-established, organized and systematized one, as is the gas business of to-day?" for the rapid increase in the means of production and its demand by the public has left little time for the solution of many problems which have presented themselves to our notice. But when we remember that the best scientists of our land, and almost within sound of my voice, with millions of capital invested to assist them, are laboring in that direction to-day, the results can only be a question of time, and the material benefits will increase with each succeeding year.

Does the combination satisfy the public? In regard to this I am able to speak from experience. To a much greater degree than could be expected; for the charges for gas and electricity can be arranged at a fixed and fair rate known to all, while under the separate system any price is charged or concession made that will secure or retain a consumer.

Has the introduction of the electric light been at the expense of gas? I think the written records of the gas companies of the United States will confirm the statement that the introduction of the electric light has been the means of increasing to a marked degree the consumption of gas, as it created the demand for more light. The increased production of oil stimulated and compelled the producers to improve its means of use, and to-day the artistic oil lamp finds its way into many a home, a rival to any artificial illumination. The increased demand for gas and the active competition encountered has resulted more in the decrease in expense of production than in the means of improvement in light and artistic decoration, save in a limited direction, while the introduction of the electric light has been received by the public with marked favor, possessing, as it does, many advantages over gas, and it may to-day be called the luxury of domestic life. If the same energy should be expended in the production of better burners, the field could be held for a longer period of time.

The incandescent light has one virtue, and to the inventor we should be truly grateful. As the life of the lamp is limited, you will never be troubled with the chronic crank who, when he complains of the diminution of light, and lays the trouble to the poor gas, says, "Why, they are the same burners I have used for 20 years."

The amount of capital required to furnish an equal amount of light per burner of the incandescent light by the present means of distribution is far in excess of that required for gas. The unreliable and unsatisfactory manner of charges for light, with the troubles of renewals of lamps, renders the system far from perfect; and there are many who, from points of economy, will continue the use of gas. Gentlemen, the solution of the problem of combination lies with you.

The question has been asked, what will be the effect upon the part of a combination when the use of the electric light becomes so general that the gas department is useless? Gentlemen, that day will never come, unless the gas companies of this country continue in the beaten path they so long have traveled, and fail to notice the rich fields that lie beside them awaiting the hand of the plowman. A gas company with a capacity of 100,000,000 per year can produce five times the amount upon the same capital, with results equally remunerative, if not materially increased. We wait for a Moses to lead us to the promised land of fuel gas. I sometimes think that I should like to turn back the years of time, from the silver hair and faltering step of age to the flaxen hair and vigorous step of youth, and standing upon some hilltop, looking down upon the cities of the nation, and when the sun sinks below the horizon, realize the coming time when the unknown of to-day will shed its brightness and blessing upon every mansion and cottage of the land. The universal light of the world, and the pure air of heaven, no more polluted by the products of combustion, and that great blessing to mankind, the lucifer match, banished from every household; and the weird spirit of the black diamond of the field, by the turning of a stop and the pressing of a knob, will find its way into every home; and the chilling winds of winter may be tempered to the life-giving warmth of a summer day; and the ash barrel, coal scuttle and kerosene lamp be retained only as bric-a-brac of a departed age.

On motion of Mr. Nettleton, the thanks of the Association were voted to Mr. Stiness for his able and interesting paper.

[To be continued.]

The Advantage of Gated Patterns.

A "Sand Artist," writing on this subject in the *American Engineer*, says:

How to cheapen the production of castings, is in these days of close competition a question of very great importance to foundrymen, and as the item of labor is in many instances the most important one, it is only natural that it should receive the greater amount of attention.

Where large quantities of castings are wanted that are light, and do not cover too great a surface, few systems have offered the advantages that gated patterns do; but, unless there are a great many to make, it will not pay to gate them, for a gate of patterns, even though they are small and plain, soon run into money if they are properly made and finished, and if they are not, they are little if any better than loose patterns.

The superintendent of a large and well-known manufacturing concern once said that any machine was cheap that paid a good dividend on its cost in the amount of work it produced and the labor it saved.

A set of gated patterns may not be a machine, but they are a labor-saving device, and so is a machine; thus the same rule is applicable to both.

A strong argument in favor of gated patterns is the quality of work produced by them; another advantage is that where the casting is part in the cope and part in the drag, the joint at the parting is scarcely perceptible, as the pattern is rapped through the hole left by the gate pin before the cope is lifted off, and not at all afterward, thus insuring a good lift as well as a true casting.

When these points are considered, together with the fact that from 30 to 50 per cent. can be saved in time, it can readily be seen that they are worthy of consideration.

Gated patterns are generally made of metal; sometimes of soft, or white metal when they are got up in a hurry to rush out some special job that may never be used again, but usually of brass when designed for general use, as they are much the cheapest in the end.

Iron is seldom used, on account of the difficulty in soldering the patterns to the gate.

One of the disadvantages of gated patterns is, that at best they are frail and must be handled with care, and cannot be successfully used on a wood or plaster paris follow board, as they are sure to come apart where soldered. To get the best results from them, they should be used on a sand match made of new sand, with about 1 of flour to 12 of sand, and it should at all times be kept moist, for if allowed to dry out and become hard it will be no better than a wood or plaster board.

Follow boards made by what is known as the oil mixture, can be used to an advantage if made elastic by the free use of oil when making the mixture, but the patterns cannot be kept soldered on the gate, unless used on a follow board that is to a certain extent elastic. A great deal

of the trouble caused by patterns getting loose from the gate is in their faulty construction.

It is very often the case that the gate and runner are cast in one piece and the pattern proper in another, and then soldered together at the point where the gate comes in contact with the casting; these two points afford so little surface that it is next to impossible to make them hold without leaving considerable solder around the gate, which in the casting must be ground or chipped off.

By casting the pattern with the gates attached, and having the runner a plain bar with plenty of draft on the sides, and with a slight taper from the center toward each end, and a swell in the center for the gate pin or sprue, and then fitting the stub ends of the gates to the runner, there are two broad surfaces brought together, which when properly soldered make a very strong job.

Sometimes the patterns on gated work are so heavy that considerable difficulty is experienced in keeping them on the gates, as the rapping to loosen them in the sand is so severe that the solder becomes loosened, or they break at the juncture of the gate and the pattern. This may be overcome where the gate is large enough to permit, by pinning the pattern and gate together with iron or steel pins; and where the gate is too small for this, flat pieces of iron or steel may be let into the cope side, extending across the weak point, and either riveted or screwed to the runner.

The writer has used patterns strengthened in both ways as described above, which worked satisfactorily.

Gated patterns are seldom used on the floor, but in the manufacture of malleable castings, and light hardware specialties in either brass or iron, they are unequaled.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. J. G. Miller, formerly in charge of the works at Green Bay, Wis., died on the 2d inst. He was a man of retiring disposition, but had many warm friends among the fraternity. He was an active and valued member of the Western Gas Association.

Another exposition of a marvelous fuel gas making process was had at Elyria, Ohio, on the afternoon of the 7th inst., and it strikes your correspondent that it is rather queer that these "views" and the exhibitors thereof manage to attract not only the attention but also the personal attendance of some of our most representative gas men. For instance, at this *seance* were present Messrs. Lindsley, of the Cleveland (O.) Peoples Company, H. H. McDuffy, representing the Westinghouse Company, C. M. Higgins, of the Standard Oil Company, R. T. Scowden, of Louisville, Ky., and many others. By the way, does it not seem strange that the Westinghouse Company's division allotted to the development of artificial fuel gas is not more active? In fact, I have been told that they have some second-hand experimental apparatus for sale. Another striking circumstance is that Ohio develops many striking situations in the line of fuel gas displays. The Proctor exposition at Defiance, Ohio, is of course still fresh in the minds of your readers, and if I mistake not the immortal Johnson originally held forth at Columbiana, in the Buckeye State. Still, as this has nothing to do directly with the Elyria case, it might be as well to say that the latter was nothing more nor less than an exhibition of the Sutherland system of oil gas making, which I believe has already been exploited in New York in the shape of a stock company; and perhaps the idea is to work up to a similar climax in Ohio. Col. D. M. Yeomans, who I understand has secured the right to the Sutherland patents in Ohio, was the host at Elyria, and the party assembled for the purpose of inspecting the operation of a practical run of the Sutherland system in a $1,000 plant that had been installed on some portion of the Elyria Gas Company's property. The Colonel does not make as great pretensions to cheapness for the gas made under this process as the Omega Gas Trust claims for its bantling; his figures being 25 cents per thousand in the holder for a 25-candle power gas, while heating or fuel gas is to cost something like 12½ cents per thousand, stored. But the Colonel does claim great saving in the expense of plant. He uses crude oil for firing, and I might add that the apparatus for gas making as shown at Elyria was decidedly crude, too. The Colonel says that Sutherland's type of gas plant is now in successful operation at Americus, Ga., Asheville, N. C., and at Rondout, Hastings, and Dobbs Ferry, N. Y. From what I know of the Sutherland operations at Rahway, N. J., and from what I can glean of the results at Hastings and Dobbs Ferry, I can arrive at only one conclusion; and that is this: The gas fraternity need not be consumed with anxiety over the outcome at Elyria.—T. A. J.

About the middle of last month the employees of the central post office at Chartres, France, were greatly perturbed at a violent explosion which shook the building and prostrated three of the clerks. As no immediately reasonable cause could be assigned for the affair, the officials at once promulgated the opinion that dynamite and dynamiters were to be charged with the results. In time, however, it cropped out that a leaky gas service was the real offender.

Recent Pennsylvania incorporations are: Quaker City Fuel Gas Company, of Philadelphia, capital, $10,000; Equitable Heat and Light Company, Waynesburg, capital, $2,500.

From and after the 1st prox., the net rate for gas consumed in Woburn, Mass., is to rule at $1.80 per 1,000 cubic feet. The exceedingly liberal allowance of 15 days from presentation to payment of bills is granted as the scope for securing the discount. This is equivalent to a reduction of 20 cents per 1,000, and ought to secure the introduction of many gas cookers this summer in busy Woburn.

Mr. O'Neill recently introduced a measure in the New Jersey Legislature that sought to fix the rate for arc lighting in the State at the figure of 40 cents per arc per night; incandescent lamps to be supplied for one-quarter of a cent per hour. When a vote was reached, it was found that 42 members thought O'Neill was wrong, whereas 8 agreed with his views.

On April 1st the Rockland and Thomaston (Maine) gas rate is to be reduced to $2.50 per 1,000. Good for Rockland!

The Omaha Company, thinking that too large a force was being carried in the purifying department, determined to reduce the same. The men did not look at it in a similar light, and demanded that no change be made. The Company, however, ordered the reduction, whereupon the men resigned. They received $1.75 per day for this labor, and are now engaged in an attempt to class themselves as skilled workmen. That strike ought not to discommode the Company very much.

In response to the invitation to contractors from the city of Galveston, Texas, to bid on the public lighting of that place by electricity, for a term of 5 years, from May 3, 1889, seven proposals were received—it may be remembered that the bids received by the city on a similar proposition some weeks ago were all rejected. The bidders submitted with their proposals a plan of distribution and arrangement for the street lighting, and specified the kind, number and power of the lights they proposed to furnish for streets, as also for the public buildings. Separate bids were submitted for the furnishing and installation of an electric light plant, suitable to light the city and the city buildings, the bidders furnishing the complete outfit, except the ground and necessary buildings for the station, and guaranteeing their machinery, as well as the cost of the annual running expenses, for a term of 5 years, payments to be made in 5 annual installments. The bids are appended:

Brush Electric Light and Power Company, Galveston, city to rent lights: 150 arcs (2,000-candle), moonlight schedule, $120 per lamp per year; all night schedule, $130. Incandescents, 16-candle power, moonlight table, $24; all night, $26; 25 candle power, $28 or $30. City buildings, 16-candle power, 1 cent per lamp per hour.

Marr Construction Company (Pittsburg, Pa.), to furnish a plant to be run by the city: Incandescent system, 250 sixteen-candle power lamps, complete, $4,207.54; 150 arcs, 2,000-candle, complete, $37,224.42, or a total of $41,431.96.

Thomson-Houston Company (Chicago branch), for rent to city: 150 arcs, 2,000-candle, at $135 per annum each, all night table, and 300 16-candle incandescents, to use at city's pleasure, for $300 per month; or to furnish complete plant of above noted capacity to the city for its operation, at $47,500.

David Hall, representing the Western Electric Company, proposed the following:

1st. To furnish 150 arcs (2,000-candle) at $123 each per annum, and 250 incandescents (16-candle) at $10.45 each per year.

2d. To install an independent plant of a capacity of 175 arcs and 250 incandescents complete for $39,875, to be paid in five equal annual installments, and to maintain and operate same on the basis of a payment of $94.70 per annum per arc, and $8.50 for each incandescent.

3d. To install a like plant in the water works station, and operate the same on the basis of $44.90 and $4 per year, respectively, for each description of lamp.

4th. To furnish the plant and pay the entire expense of operation con-

nected therewith for $1,595 per month (60 monthly payments), this sum to cover the entire cost of plant, operation and maintenance for the time specified.

5th. To construct the plant and take $1,790 per month for 36 months, to pay for the plant and the expense of its operation.

6th. To put up a smaller plant (160 arcs) and maintain and operate the same without further expense to the city than $14,900 per year, which amount is to include cost of plant.

The Galveston Gas Company offered to supply gas to lamps (moonlight table) at $24 per lamp per annum; gas to public buildings to cost $2.25 per thousand.

In the above only five bids are given because the others (the Electrical Accumulator Lighting and Power Company, of St. Louis, and W. T. M. Moltram, of Dallas, said to represent the Edison Company, of New York) failed to accompany their proposals with a certified check for $1,000. The committee having the matter in charge were to have reported their conclusions to the Council at a meeting to have been held a week ago, but we have not heard what result, if any, was reached.

THE Worcester (Mass.) Gas Company has taken a long step ahead in the matter of catering to the convenience of their customers by selecting new office quarters right in the heart of the city. The premises selected are at No. 33 Pearl street, one door from the Post Office, and that explains it all on the ground of convenience. But convenience is not the only object that the Company has in view, for it is proposed to carry an extensive assortment of gas cookers, heaters, burners, etc., so ticketed that any consumer who cares to "know, you know," about such articles, provided he can read, may at a glance satisfy himself, and perhaps move him to the point of inquiring their value and utility from the polite and versatile clerk in charge of the showroom. The fitting up of the place is to be in the very best modern style.

MENTION of this move at Worcester puts us in mind of the fact that the Brooklyn, N. Y., companies have always paid close attention to their office arrangements, although perhaps the Fulton-Municipal Company should be awarded the palm for completeness in their method of arranging and displaying available utensils for increasing the day consumption of gas.

THE snarl in lighting matters at Mankato, Minn., brought about by the sudden death of the originator (Mr. O. C. McCurdy, who died in the spring of 1887), seems to have been straightened out at last. In any event the Mankato Gas and Electric Light Company has been organized, and its proprietors, having secured control of the stock in both branches, will carry the property on under the combined plan. The officers of the Company are: President, John F. Meagher; Vice-President, F. L. Watters; Secretary, R. E. Brown; Treasurer, Geo. M. Palmer. The Company is capitalized in $200,000, and the Manager will be Mr. F. C. Watters.

THE Superintendent of Lamps, Boston, Mass., reports that during the past year the changes in the public lighting service were as follows: Number of new gas lamps erected, 250; oil lamps, 310; 64 oil lamps were changed to gas, and naphtha burners were placed on 49 lamps of of the oil variety; 127 arc lights were added, and 17 high-power gas lamps were located—the latter are said to have given good satisfaction. There are 704 high power arcs maintained by the city.

MAYOR GLOVER, of Marietta, Ga., insists that that place shall be lighted by electricity. He is in the market for proposals.

THREE loafers in Louisville recently amused themselves by smashthe glasses in the public lamps on Hamilton street. It pleases us to add that President Morris caused their arrest, and they subsequently paid $20 each for their amusement.

THE incandescent electric light company of Shreveport, La., never was a very solid corporation, but its weakness will soon be a thing of the past, for Mr. F. A. Leonard has been appointed receiver for the property, with instructions to wind the concern up. He will not need a very long reel, either.

A VERY interesting paper, on the "Efficiency of Methods of Artificial Illumination," was read last Tuesday evening, at the lecture room of the College of the City of New York, by Prof. Edward I. Nichols, of Cornell University. The reading was profusely illustrated by means of lantern slides.

THE contest for lighting the outlying portions of Chicago by means o gasoline lamps was quite fierce this year. The bidders and figures are annexed:

Northwestern Globe Gas Light Co.....	$19.20 per annum.
Home Illuminating Co.....	20.00 "
Globe Light and Heat Co.....	20.00 "
Western Wheeler Reflector Co.....	18.50 "

After a lively debate the Committee recommended that the contract be awarded to the Northwestern Company.

WE understand that the San Antonio (Tex.) gas works are to be virtually rebuilt.

IN our note of the contract for Flemming benches at the Philadelphia works, we should have said that the contract called for 24 benches of 6's, instead of 12 as stated. The installation is to be made at the Point Breeze Station. The ironwork is to be furnished by Messrs. Floyd & Sons, while the clay materials are to be supplied by Messrs. Gautier & Co., of Jersey City, the bench construction to be under the supervision of Mr. Flemming.

ELSEWHERE is noted the bids received by the special committee on public lighting, Galveston, Texas. Since that was put in type we have received the following, respecting the report made to the Council, with a recommendation as to the plan to be adopted by the city. In effect it is a consolidation or adaptation of the leading features of several of the six propositions submitted by Mr. David Hall, on behalf of the Western Electric Company. The recommendation is that the city contract with him to furnish and install a complete electric lighting plant (capacity, 175 arcs, of 2,000-candle power each, and 250 incandescents, 16-candle) in the water works station belonging to the city, for the sum of $35,700, payable in five annual installments of $7,140 each, without interest, with the reduction of $3,000 for engines, etc., if the city prefers to furnish the engines itself, which is left to its option; and for operating the electrical department of said plant the sum of $44.90 for each arc lamp per annum, and $4 for each 16-candle power incandescent lamp. The city to have the option to discontinue the above contract for operating and maintaining the electric light plant at any time the City Council should determine to do so, by paying cash for the balance of deferred payments, the contractor agreeing to allow a discount of 10 per cent. on the amount at that time unpaid; the said 10 per cent., however, to be in full for the unexpired time on all the deferred payments, independent of the time for which they are yet to run. Perhaps the Council will acquiesce in these recommendations, but in view of the agitation going on just now in Texas—and particularly in the neighborhood of Galveston—respecting "deep water" matters, it might be better were the authorities to devote their attention to steering clear of all shoals. The establishment of a municipal lighting plant there might possibly land the city high and dry.

THE number of electric street lights maintained in Portland last year is returned at 734—29 arcs (2,000-candle power), and 705 incandescents (16-candle power), the total monthly cost of same being $2,182.32. At the beginning of 1887 645 lights—25 arcs and 620 incandescents were in use—the monthly payments thereon being $1,917.17. The average monthly cost for each arc at present is $21.15, while the incandescents average $2.18 each. These lights are operated each night and all night, but it is now urged that they should be extinguished on "clear moonlight nights, if it could be arranged that some officer of the police department could order the lights turned on in case the weather became unexpectedly cloudy." The officer of the police department so designated ought to feel flattered if it ever comes to pass that such an arrangement is made. In the meantime the lighting department of the city is looking for a purchaser for 450 oil lamps, complete and in good order.

THE Mayor of Richmond, Va., strongly indorses a recommendation from Supt. Adams, of the city gas works, that an additional holder, to have a capacity of 750,000 cubic feet, be placed in the western part of the city. Gas men conversant with the situation will also admit the reasonableness of Supt. Adams' suggestion.

THE Havana (Cuba) Spanish-American Light and Power Company have completed the installation of an electric lighting plant. It is of the Westinghouse type, and has a capacity of 80 full arcs and 2,500 incondescents. The annex is now in working order, so that the people of the "Ever faithful Isle" can make their choice between gas and electric light as supplied by the local gas makers.

In connection with the remarks of Richmond's Mayor, it might be further explained that he favors the operation of a municipal electric lighting plant.

The Equitable Gas Improvement Company, for the manufacture and sale of illuminating and fuel gas, has been incorporated at Aurora, Ills., by Messrs. Henry Pratt and Jno. and Peter Halmer. It has been capitalized in $100,000.

The Harrison (N. J.) Electric Light Company's troubles still continue. The paymaster promised to settle with the laborers, but as he never went beyond the promissory stage, the men finally attached the Company's tools, poles and wires. "Tools, poles and wires," however, are rather unlikely assets.

Last week a garnishee process was served on the Peoples Gas Company, of Cleveland, Ohio, because of a suit commenced by David Pinkney and others, of London, England, against the "English Cannel Coal Company," Limited, of England, which incorporation owns or operates the Warsaw cannel seams of Warsaw, Coshocton county, Ohio. Complainants want $4,850 on a draft accepted by the cannel company, and the garnishee served was merely to attach any possible indebtedness to the cannel company on the part of the gas company.

The Spartanburg (S. C.) Gas Company, which has been put in pretty good shape by its new owners, commenced a few days ago to supply gas. The residents are pleased with the service, which is voted by all a vast improvement over the ancient practice.

Bellevue, Ky., has entered into a contract with the local gas company. Under it the city agrees to pay $32.50 for each gas post maintained on an all night and every night schedule; the company, on the other hand, agreeing not to charge in excess of $1.75 per 1,000 cubic feet for gas supplied to private consumers. That is a very low rate to consumers, even if the lamp charge does appear out of the normal.

Mr. W. Ervin Penington, ex-Controller of the Philadelphia Gas Works, under the Trust regime, and well known in Quaker City real es tate matters, died a few days ago in Denver, Col., whence he had journeyed some months back in the hope of bettering his health.

Within the last few months it was noted "up Hartford way" that there was a steady and persistent demand or inquiry for loose shares in the old steam heating company. Now, this concern was not known to ever have been a veritable gold mine for its owners, and the inquiry for its stock, which seemed to proceed from pretty good people, caused no little wonder. It is all out now, however; for it seems that the purchasers were after control simply for the purpose of giving a local inventor an opportunity to show what he could do in the line of manufacturing and distributing a cheap fuel gas. Mr. Burdett Loomis is the inventor, and the force behind him is David Henney, President of the Light and Power Company, which it is proposed to revive out of the dismembered skeleton of the steam company's franchises and property. But in Connecticut articulation does not place a company in the museum of business; the Legislature must vitalize it. As the Light and Power Company now proposes to manufacture and distribute gas, thus departing from its avowed original intention, it must have legislative authority to go on with the work. The Legislature was appealed to for the necessary enabling act, and the incorporation's committee have been taking testimony in the attempt to arrive at a decision. At one of the sessions a certain Mr. David Clark was examined, and he testified that he and several others of his acquaintances were absolutely aching for a chance to use fuel gas. On cross-examination witness admitted that the old Hartford Company had signified its willingness to furnish Clark and his friends with fuel gas, but he (and no one doubted him) would rather take his supply from a company—the Light and Power Company—in which he was interested, although by waiting for his own pet project to start up his "burning" stage was only protracted. At a subsequent hearing Burdett Loomis was examined, and I suppose I need hardly tell gas men that Loomis put his case pretty well. What a capable clergyman Loomis would make! He spoke about glittering generalities for one spell, and in the next moment dropped into figures and facts about generators, producer gases, quantities in thousands of cubic feet. He incidentally noted the great success at Tacony, Pa., but never a word about Cottage City, Mass., was dropped. President Henney told how he had acquired control of the Steam Heating Company's property and rights, asserting that the new company holds the old one's notes for $40,000, besides $60,000 worth of its stock. He concluded by admitting that those now in interest with him proposed to utilize the old steam mains for distributing fuel gas, simply because, as he said, "the steam heat system is unprofitable." But he forgot to explain an instance where the distribution of fuel gas pure and simple was profitable. Certainly not at Troy, N. Y., Los Angeles, Cal., or at Lynn, Mass. That model business man, Mr. Jos. L. Howard, President of the Hartford Gas Company, made a statement, which although delivered in his usual calm but impressive way, I believe will do more for the old Hartford Company in this examination than anything its proprietors may subsequently advance. He simply objected to the prayer of the petitioners on the ground that the Hartford Gas Company was chartered to manufacture and distribute gas of any kind desired; that it stood ready to distribute fuel gas as cheaply (cheaper, in fact) as it could be furnished by any other company, and that if the demand for it were proven his Company would at once enter the field. And the supply would be made at a figure that would only yield a fair profit. In other words, President Howard would try to make a profit in selling gas rather than trust to a reward gained in the issue of stock. I know it has often been said to inventor Loomis that he ought to demonstrate the value of his fuel gas right in Hartford; then he could go out to the country and say, "Behold! I have made a success of my plan in the city that claims me." With such references he ought to be able to count on a valuable lever to force his way into "pastures green and fields anew." Perhaps it is his ambition to do so now, on the theory of "better late than never," yet I fear the scheme is to save the steam heating Company's skeleton. There can be no doubt about it that the latter almost reached the glistening stage. I hope to send you on something more about this matter. Haddam.

A correspondent, not over 50 miles from Lansing, Mich., having given us the dates of certain issues of the Jackson *Patriot*, *Citizen* and *Courier* which contained references to troubles connected with the supply of fuel gas in that city, also said: "Some of us in the West note with satisfaction your comments on the Jackson situation, for I see you are acquainted with the true inwardness of the fuel gas institution there. There can be no doubt that many have visited Jackson to investigate the claims made by the Jackson National Gas Light and Fuel Company; but I have yet to find the practical gas man who went away from there in a pronouncedly enthusiastic state over what had been shown him. So much has been said of the great draft made by the opposition on the old Company that I think it might be well to say that from Dec., 1887 (National Company started up then) the old Company has sustained a net loss not to exceed 25 consumers—probably not over 20." We have obtained copies of the journals above named, and on looking them over we find four accounts, on as many different days, of accidents similar to those which led up to the fatal disaster in Troy, N. Y., on Jan. 16, 1887. The papers and dates are as follows: Jackson *Daily Citizen*, Feb. 18; *Morning Patriot*, Feb. 23; *Daily Patriot*, Mar. 5; and the *Evening Courier*, Feb. 23.

The following liberal proposition on behalf of the Peru (Ind.) American Gas Company, has been submitted by Supt. Wm. Tracy to the City Council: "The Peru American Gas Company will furnish the city of Peru with 25 arc electric lights for $1,800 per year; 60 gas posts for $1,800 per year; additional arc lights at $75 each; additional gas posts, on line of our mains or new mains that may be laid, for $20 per post. Will break contract now existing and enter into a new one with the city for above for five years. Will donate five posts belonging to the Company already set, and will stand half the expense of removal of all posts now up to where the city may want them placed." Further, if this proposition be accepted by the Council the Company agrees to reduce the rate to $1.50 per thousand to ordinary consumers. Those who know the location and size of Peru will concede that 25 arcs and 60 gas lamps would light the place up in good style, and when compared with the practice and the cost of the lighting now obtaining there the city would be a great gainer. In other words, the city would get 20 additional gas lamps for nothing, and the arc lighting (moon-table) would cost but $72 per lamp.

We understand that Anthony N. Brady and others, who purchased the plant and franchises of the defunct Troy, N. Y., Fuel Gas Company, and also secured control in the Troy Citizens Gas Light Company, propose to either crush out or buy out the Troy Gas Light Company. Since they succeeded in inducing the Council to amend the charter of the Fuel Gas Company they have power to sell illuminating gas over the entire Troy district. We believe, however, that they expect to have to pay a better relative price for the old Troy Company than they did pay for the old Albany Company.

WE understand that Mr. Hennessy, one of the prime movers in the building of the works at Rochester, Minn., has secured a charter for a works at West Superior, Wis., which is a right lively place, opposite Duluth, Minn. The town Trustees have entered into a contract with the organizers of the Company, under which it is agreed that West Superior shall light its streets by means of gas for a term of 10 years, to be supplied exclusively by Mr. Hennessy and his associates, We understand that the rate to be charged (maximum) is $2 per 1,000; and further, that the laws of Wisconsin specifically provide for maintaining a contract between a municipality and a corporation of the character noted. The acts of one Council, in respect to their binding effect on their successors in the matter of contracts, can be made to cover a period of 10 years.

THE Rochester (Minn.) works were fired up about three months ago, and bid fair to become a valuable property. The Springer system there in use is giving good satisfaction.

SENATOR SPOONER is very "greatly disappointed" over the failure of his efforts to chastise the Washington (D. C.) Gas Light Company. He might better direct his energies towards "conserving" the lumber districts of his region. He knows something about these.

THE Toledo (O.) Company is making water gas exclusively. In connection with this city we have been told that many of those who use the incandescent electric light there allow it to burn all through the day—it "comes so cheap."

Inspection and Use of Cement and Mortar.

Mr. S. F. Burnett, at a meeting of the Engineers Club, St. Louis, Mo., read a very interesting paper on this subject. Omitting his references to selection and inspection of a proper cement, we abstract the following from his address:

From the foregoing we will assume that we can get a good cement. Having a good cement, we will not get a good mortar unless we have a good sand and the two are properly mixed and worked with the proper amount of water. The sand is much easier tested than the cement. Its quality can always be determined by its looks, feel, etc. The sand should be clean and sharp (I do not think necessarily coarse, although it is generally so required). Both sharpness and cleanliness may be tested by taking a handful of the sand, in its moist state as it comes from the barge, and pressing it together with the fingers. If the sand is good it will not stick together, but immediately fall apart when the pressure is relieved. If it sticks together it is probably loamy or dirty, and is not good. Sand may also be tested by crushing a handful near the ear; if it is clean and sharp it will have a grating sound. It may be further tested for cleanness by washing a little in the palm of the hand; the hand should be left clean. It is almost as necessary to have a good sand as it is to have a good cement. The effect of poor sand is shown by the following, using the same cement and different sands: One of cement and two of good sand, setting four months, stood 73 pounds; one of cement and two of poor sand, setting same time, stood 60 pounds; one of cement and one of good sand, setting four months, stood 115 pounds; one of cement and one of poor sand, setting four months, stood 72 ponnds.

The consistency of the mortar depends somewhat on the kind of work on which it is to be used, and on the state of the atmosphere. For a material that absorbs very little water, such as granite, a stiff mortar should be used; for a material that absorbs much water, such as brick, a thinner mortar should be used. In cool, damp weather a stiff mortar should be used. When a stone or brick is once well set in mortar (say for half an hour) it should not be disturbed; if it is necessary to move it, no matter how little, it should be taken up, the old bed of mortar scraped up and thrown away—not remixed and relaid—and a new bed of mortar laid.

In making mortar the amount mixed at a time depends on the rapidity with which it is used. It is very important that it should not be mixed faster than it is used; any mortar that has been mixed one hour is almost worthless. Using Louisville cement, the following are examples to illustrate: Fresh mortar, setting three months, stood a test of 60 pounds; same mortar remixed after standing one hour, setting three months, stood onty 33 pounds—27 pounds less. Another case of fresh mortar, setting four months, stood 62 pounds; this mortar, remixed after standing one hour, setting four months, stood 40 pounds—22 pounds less. With a Portland cement, which is generally much slower setting, the mortar can be kept longer; but I think the sooner it is used after being well mixed and worked the better the result. A cement mortar made of one of Louisville cement and two of good sand should stand a tension strain of not less than 50 pounds to the square inch when setting three months in the air.

In my experience I have found that freezing of mortar before it is well set always weakens it at least. A mortar laid in freezing weather may turn out very good, but I do not think it is ever as good as it would have been had it been laid in warmer weather. If a mortar has a few hours to set before freezing (say, during the day and freeze at night), the effect is not nearly so bad as if it should freeze as soon as laid or shortly after, and then remain frozen for several days (until it has dried), the effect is not so bad as it would be should it thaw within one or two days after freezing. The following are some experiments showing the effect of freezing: Sample of Queen City Star cement, mixed neat, and setting in moderate temperature, stood 421 pounds. Same cement allowed to set 15 minutes and then frozen and kept frozen several days, stood 290 pounds. Same cement frozen as soon as mixed, and kept frozen several days, stood 260 pounds. Same cement frozen as soon as mixed and thawed out next day, stood 88 pounds. All these samples set 2½ months in air. Sample of Black Diamond cement setting without freezing, stood 410 pounds. Frozen as soon as mixed, and left exposed to weather, stood 121 pounds. Frozen after setting 15 minutes, and left exposed to weather, stood 163 pounds. Frozen after setting 30 minutes, and left exposed to weather, stood 197 pounds. One of this cement and two of sand set without freezing, stood 142 pounds. One of this cement and two of sand frozen after setting one hour, stood 65 pounds. From these experiments it appears that freezing of mortar before it is perfectly set can do nothing but injure it.

Limes differ about as much in quality and strength as cements, and have the disadvantage that they cannot be tested as cements, except by appearance; and a great disadvantage of lime is that too little sand added is almost as bad as too much. More or less sand than the proper amount will weaken the mortar; so, unlike cement mortar, it cannot be made safe by adding less sand. Again, this proper amount of sand can only be determined by the appearance and working of the mortar; hence lime mortar is very uncertain unless made by a trustworthy and thoroughly practical mortar mixer.

The lime used should be fresh and in compact lumps, free from much dust of air-slacked lime. These lumps must be thoroughly slacked with water before being mixed with sand. The lime should be left in a moist state for several days at least, to insure a thorough slacking before adding the sand. It is claimed by some authorities that the longer the lime stays in this moist state the better.

Sand and water are added to and worked with this moist mass of slacked lime to make a mortar of the proper consistency; this should be vigorously worked with a hoe. When properly mixed and worked it should leave the hoe or trowel clean when drawn out of it. It is just as important to have a good sand as it is with cement mortar. Lime mortar, when everything about it is first-class, makes an excellent mortar, but it requires such care and skill to make all conditions first-class that it is seldom that a very good lime mortar is obtained.

Weakness in Short Columns.

Mr. E. Hodgkinson, writing on this subject to the *Architect*, says that cast iron pillars with flat ends uniformly bear about three times as much as those of the same dimensions with rounded ends, and this was found by experiment to apply to all pillars from 121 times the diameter down to 30 times. In flat-ended cast iron pillars shorter than this there was observed to be a falling off in the strength, and the same was found to be the case in pillars of other materials, on which many experiments were made, to ascertain whether the results, as obtained from the cast iron pillars, were general. The cause of the shorter pillars falling off in strength was rendered very probable by the experiments upon wrought iron, for in that metal a pressure of from 10 to 12 tons per square inch produced a change in and reduced the length of short cylinders subjected to it; and about the same pressure per square inch of section, when required to break by flexure a wrought iron pillar with flat ends, produced a similar falling off in strength to that which was experienced when a weight per square inch not widely different from this was required to break a cast iron pillar with flat ends. The fact of cast iron pillars sustaining a marked diminution of their breaking strength by a weight nearly the same as that which produced incipient crushing in wrought iron, and a falling off in strength of wrought iron pillars, rendered it extremely probable that the same cause (incipient crushing or derangement of the parts) produced the same change on both these species of iron.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,

PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.

ASST. EDITOR—T. J. Cunningham.

MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT

No. 42 Pine Street, New York.

This is a recognized official organ of

LIGHT, HEAT, STEAM, WATER SUPPLY,

VENTILATION, SANITARY IMPROVEMENT,

AND GENERAL SCIENCE

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

AGENTS.

NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.

PHILADELPHIA.—PRATT & CO., Corner Ninth and Arch Streets.

Germany.—B. WESTERMANN &CO., of New York.

MONDAY, MARCH 18, 1889.

The Market for Gas Securities.

Consolidated during the week showed scarcely any change as to values. The bears did early this week "offer" the stock down to 82½, but an order to buy 200 shares at that figure elicited the response that none could be had less than 83. Equitable is not much dealt in on the Exchange, although we note a transfer on Thursday of 18 shares at 116, and the same figure was offered for another lot, without avail.

Brooklyn shares are in some demand at better prices. The contest in Citizens for control again looks like business, and the nominal market rate has been advanced to 60. We do not believe that the Francklyn party will secure control. It is also said that the insurance companies may contest the payment of losses on the holder that was *first* to collapse. The stock of the Nassau Company will likely be increased, which is only fair to holders, since the large payments recently made on account of additional construction ought not to be made a charge on revenue.

The Spanish-American Light and Power Company are paying the regular quarterly dividend of 1¼ per cent. The books were reopened last Saturday. Consolidated of Baltimore is up to 44¾ bid. We note a sale at auction of $6,000 Metropolitan (city), first mortgage sixes, at 119.

Cincinnati gas is strong and higher, while shares in the Hartford (Conn.) Company are somewhat weak over the attempt to virtually place an opposition gas plant in that city. The organizers of the Company for West Superior, Wis., are attempting to interest New York capital in their enterprise.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

MARCH 18.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	83	—
Central	466,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	4,000,000	100	112	117
" Bonds	1,000,000	—	113	115
Harlem, Bonds	176,000	—	—	—
Metropolitan, Bonds	658,000	—	115	118
Mutual	3,500,000	100	98	100
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	300,000	50	55	60
" Bonds	12,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	100	102
Citizens	1,200,000	20	60	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	125	127
" Bonds	300,000		—	106
Peoples	1,000,000	10	72	74
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	89	90
Nassau	1,000,000	25	111	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	120	122
" Bonds	1,000,000	—	111	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	240	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	—	—
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	43¾	—
Cincinnati G. & C. Co.	6,000,000	100	205	207
Consumers Toronto	1,000,000	50	192	—
Central, S. F., Cal.			—	90
Capital, Sacramento, Cal.			58	—
Consolidated, Balt.	11,000,000	100	44⅜	44⅞
" Bonds	6,400,000		107	107½
Hartford, Conn	750,000	25	110	—
Jersey City	750,000	20	165	170
Laclede, St. Louis, Mo.	2,000,000	100	—	115
Louisville, Ky.	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	204	210
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn		25	193	197
Oakland, Cal.			34¾	35
Peoples, Jersey City		—	60	61
" " Bonds.			—	—
Paterson, N. J.		25	90	—
Rochester, N. Y.		50	75	80
Syracuse, N. Y.	500,000	25	—	—
St. Louis, Missouri	600,000	50	—	—
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	62½	62¾
Washington, D. C.	2,000,000	20	190	194
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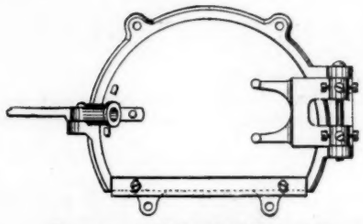

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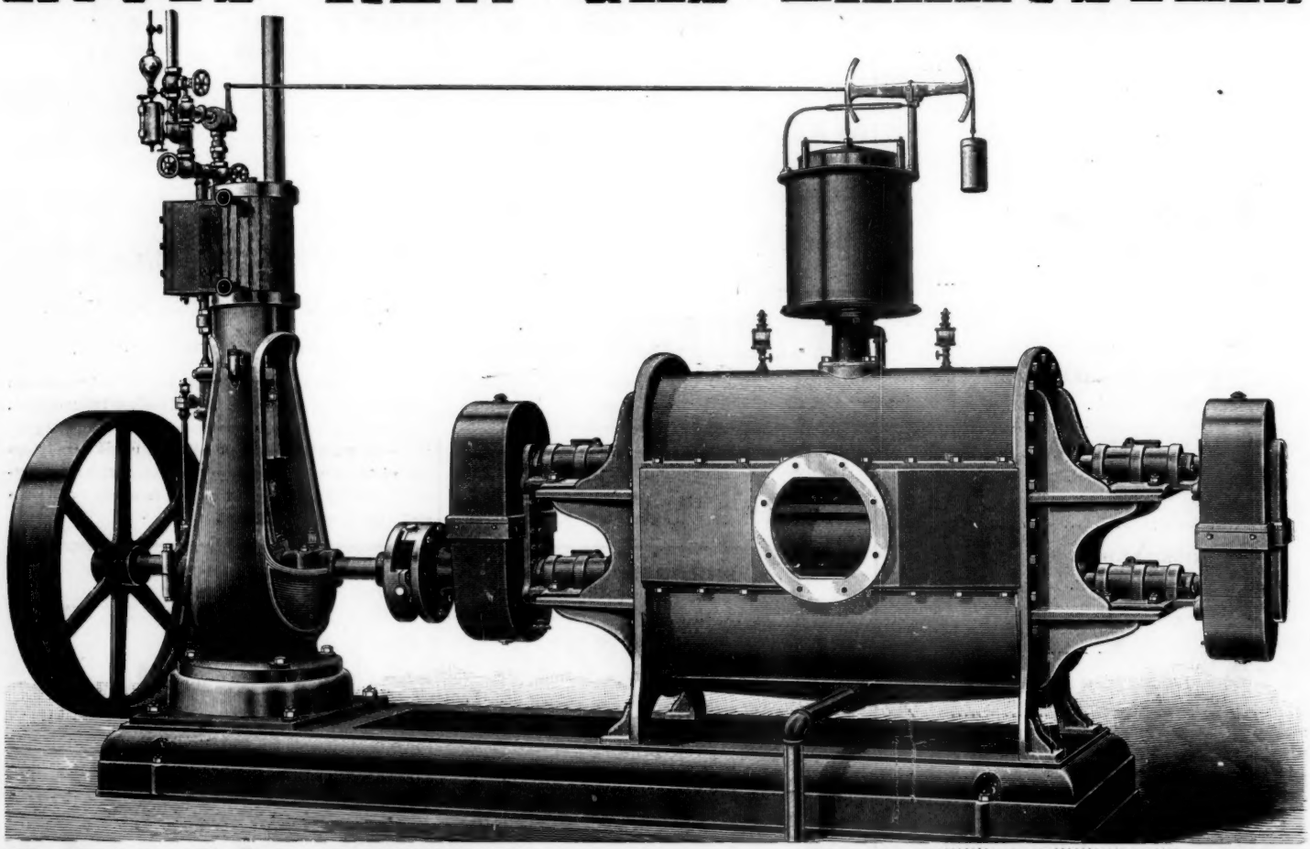

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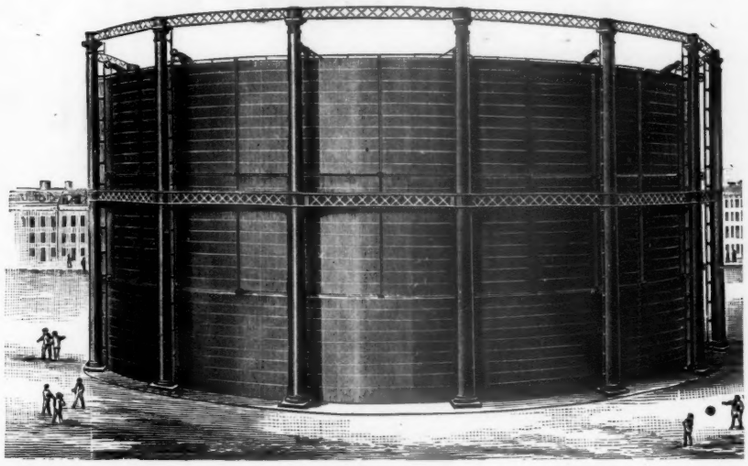

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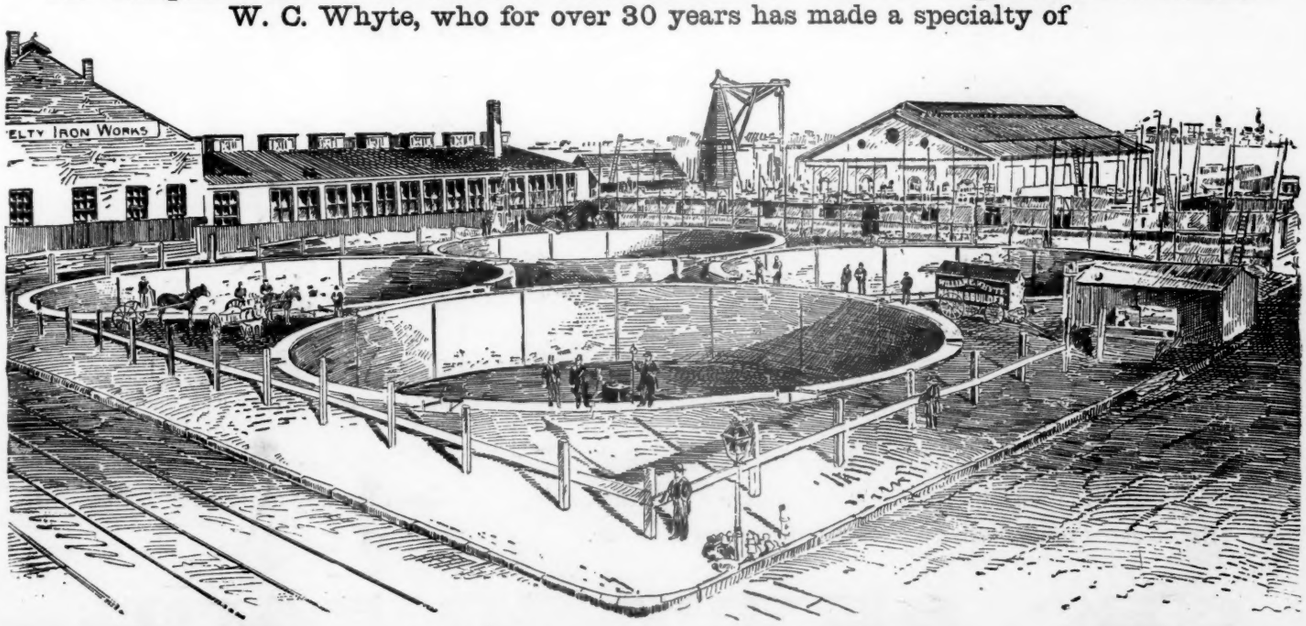

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No. 4,	"	"	500,000	"	"	"	6	"	"	" "
No. 5,	"	"	750,000	"	"	"	7	"	"	" "
No. 6,	"	"	1,000,000	"	"	"	8	"	"	" "
No. 7,	"	"	1,250,000	"	"	"	9	"	"	" "
No. 8,	"	"	1,500,000	"	"	"	10	"	"	" "
No. 9,	"	"	2,000,000	"	"	"	12	"	"	" "
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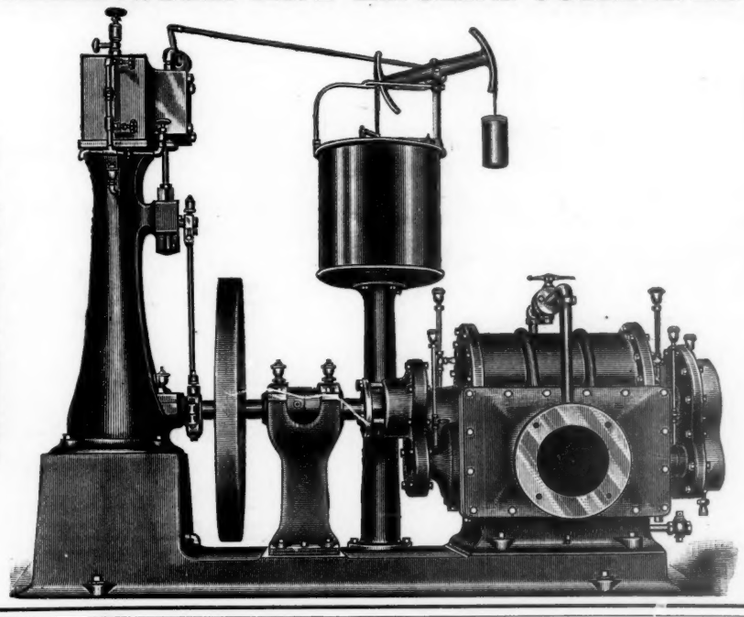

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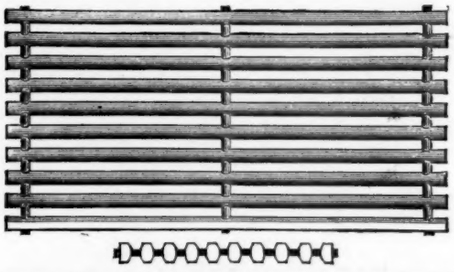

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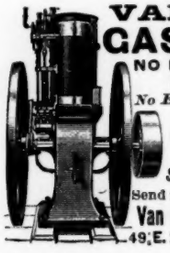

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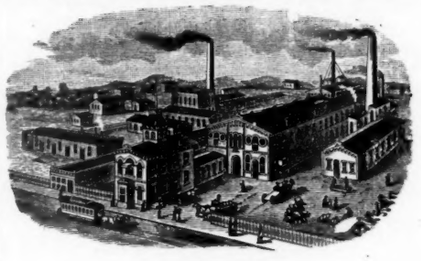

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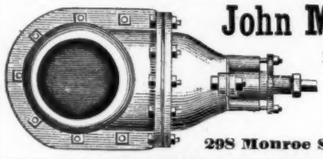

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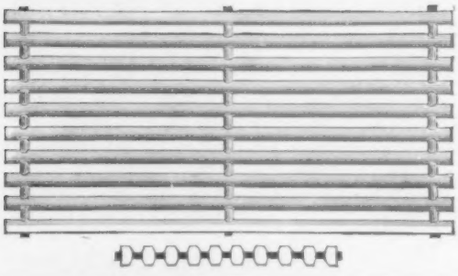

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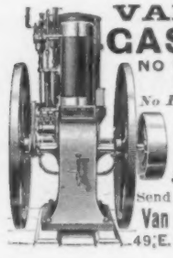

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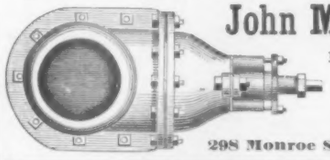

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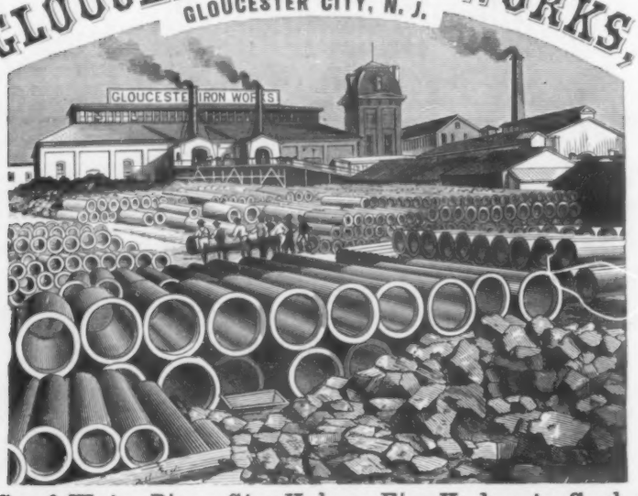

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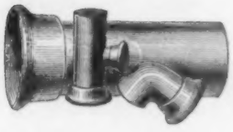

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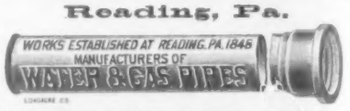

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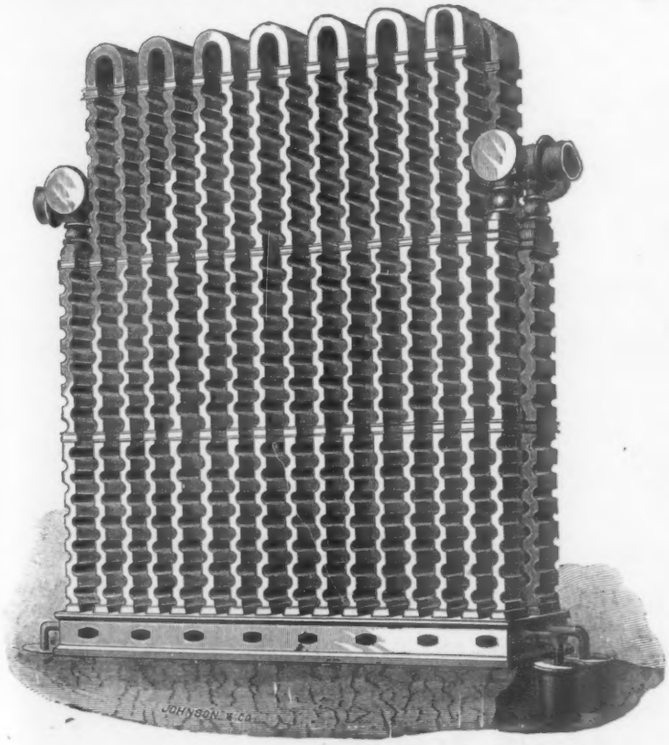

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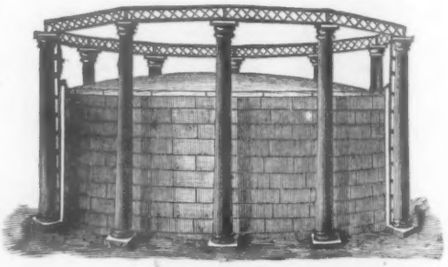

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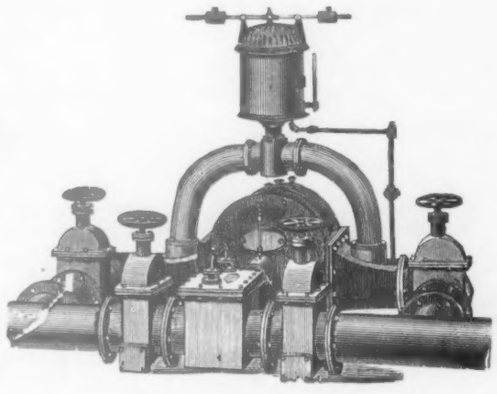

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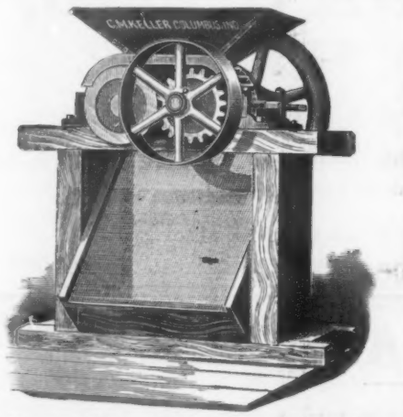

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37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

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Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

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17 in. wide.	14¼ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

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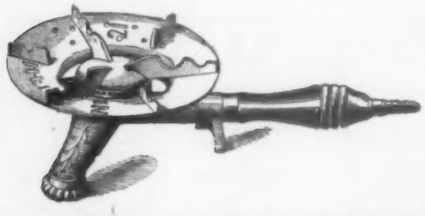
The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.



"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.